CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 NOVEMBER 1948 SIDNEY D. KIRKPATRICK, Editor

13th

Chem & Met Report

on

Materials of Construction

Building Better *for* Bigger Profits

This magazine published its first Materials of Construction issue April 16, 1923—more than twenty-five years ago. It was our declaration of war against an insidious enemy of profitable production. In those days relatively few corrosion-resistant materials were available—cast iron, wood, lead, stoneware, copper and a limited number of ferrous and non-ferrous alloys. Gradually, however, with the advent of new metallic and non-metallic materials, the tide was turned. Corrosion continues to take its toll but, thanks to our advancing knowledge and technology, it has been fighting a losing battle.

We like to think that the dozen predecessors of this 1948 Materials of Construction issue may have had some influence in helping chemical engineers in this continuing struggle. We have been honored, and to some extent mildly amused, to find that our efforts have set a pattern for others to copy—sometimes even to the exact form, titles and typography. But the front is a broad one and we have welcomed allies from the scientific societies, the trade associations and the various coordinating groups of national and international sponsorship.

Distinguished work of long standing by the Electrochemical Society, particularly on the various theories of corrosion, has lately culminated in a comprehensive

handbook that fills a real need for such a reference book. Last year the American Chemical Society launched an annual series of interpretive reviews of the research literature, along with detailed bibliographies of scientific articles on materials of construction. Since the American Institute of Chemical Engineers formed its first committee on corrosion in 1923 (at our suggestion!) its symposia have added greatly to the basic literature of the field. The other engineering societies, the newly organized National Association of Corrosion Engineers, the various trade and industry associations such as the American Petroleum Institute have carried forward this program with relatively little repetition and duplication of effort.

Over the years our own objective has been to provide *Chemical Engineering*'s readers with timely data of immediate and practical application to their daily problems in the design, construction and operation of chemical engineering equipment. Certain features such as the directory of materials and the cataloging of their corrosion resistance and other properties, have been continued through all recent issues. But each has also presented a different approach or explored a new sector of the field to help in rounding out chemical engineering knowledge and experience.

This year, for example, you may find unusually useful the unique series of pages devoted to the manufacturing processes of an important series of chemicals and process materials. Our *Chemical Engineering* flowsheets have been revised in light of most recent advances and on them are shown the various construction materials most widely used for corrosion, heat and abrasion resistance. The accompanying text outlines the whys and wherefores of current trends and practices.

So in presenting this Thirteenth Report on Materials of Construction for Chemical Engineering Equipment, it is with the expectation that it will add to the traditions of practical service first established by its predecessors a quarter of a century ago. It comes at a propitious time. Processes and equipment are changing rapidly. Many recent advances were possible only because new or improved materials have become available. Wartime plants, often built with emergency materials, continue to be replaced with more resistant construction. But in the face of rising costs the great urge today is for more efficient production. Better materials can contribute mightily in this process.

Sidney D. Kirkpatrick

Contents

Equipment & Construction Materials for:

Acetic Acid 99
Ammonia 100
Cane Sugar 101
Chlorine and Caustic 102
Fatty Acids 103
Hydrofluoric Acid 104
Hydrogen Peroxide 105
Nitric Acid 106
Phenol 107
Phosphoric Acid (Wet Proc) 108
Phosphoric Acid (Wet Proc) 109
Salt 110
Soap 111
Sulphate Pulp 112
Sulphite Pulp 113
Sulphuric Acid 114
Whiskey 115

Directory of Materials

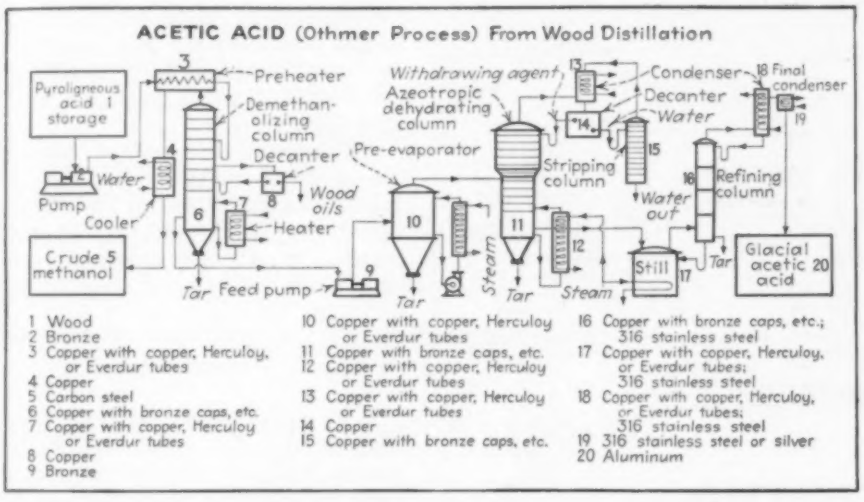
Metals and Alloys 116
Carbon and Graphite 123
Cement, Mortar, Putty 124
Ceramics 125
Plastics 126
Rubber 127

Reprints of this 32-page report are available at 75c. per copy. Address Editorial Dept., Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

Equipment & Construction Materials

For Seventeen Important Chemicals

From chemical manufacturers, from the literature, and from the producers of corrosion-resistant materials the editors of *Chem & Met* have collected this fund of information. The object, for each of 17 common chemicals, has been to present a concise summary of good, up-to-date practice in the selection of construction materials. To make the summaries more tangible and concrete, flowsheets have been prepared showing the production of each chemical—with each item of equipment identified as to construction material. The text itself elaborates on the flowsheet and goes on to discuss materials used in alternate production processes and in the shipping, using and handling of the chemical in question. In a word, the intent has been to present the reader, not with reams of disconnected data, but with a clear statement: *Here, after all is said and done, are the materials that informed engineers are actually using for specific jobs.*



Equipment and Construction Materials for . . .

Acetic Acid

Acetic acid can be produced by any one of several processes and from any one of several raw materials. The amount of acetic acid that is made by hardwood distillation has decreased in recent years to about 10 percent or less of the total. The larger amount of acetic acid is made by synthetic processes.

In the past few years, the trend in the acetic acid industry has been away from copper to stainless steel because of the price situation and the longer life of equipment. With the copper price going up and steel more or less stationary there is more reason now than heretofore to use stainless steel. This is also more or less true for aluminum which has become more popular for making and handling acetic acid, especially at high temperatures. Where a very pure product is demanded silver equipment is often used due partly to the clearance of colored substances, even if some contamination by silver does occur.

When using copper and some of the other metals care must be taken to keep air out of the system. However, the presence of air does not have the same adverse effect on aluminum that it has on these other metals. Accordingly, this metal is more satisfactory for equipment that is used intermittently.

Stainless steels, especially those containing molybdenum, can generally be used to handle all concentrations at normal temperatures. Under some conditions certain of these steels can also handle acetic acid at elevated temperatures. These materials, however, are not highly resistant to acetic acid at the boiling point, acetic vapor, or hot acetic anhydrides.

Highly alloyed stainless steels or other high alloys should be used for conditions involving the higher concentrations at high temperatures, and where purity of the product is an important factor. One such alloy, Worthite, is used extensively for pumps and valves. The Hastelloys are not appreciably affected by temperatures at or above the boiling point. Equipment made of Hastelloys B and C, which are especially resistant, can handle all concentrations of acetic acid at all temperatures and acetic anhydride with a loss of less than 1 mil per year. These alloys, however, can be economically used only where chemicals other than straight acetic acid are present.

Aluminum is preferred for high-temperature conditions, as in stills and condensers; acetic acid in concentrations up to between 98 and 99.5 percent can be handled at any temperature below the boiling point. It is only slightly attached by strong acid. The rate is higher as the dilution increases.

Copper, by and large, was the premier metal of the acetic acid industry, and still is used to a very large extent. Corrosion of copper can be controlled to a considerable extent. It is accelerated by the presence of air, as is evidenced by the fact that leaky equipment is always short-lived.

Silver is recommended as a material of construction resistant to corrosive attack by acetic acid in all concentrations and at all temperatures. Apart from the use of silver for its corrosion resistance are the superior heat transfer qualities and the ease of fabricating complicated shapes.

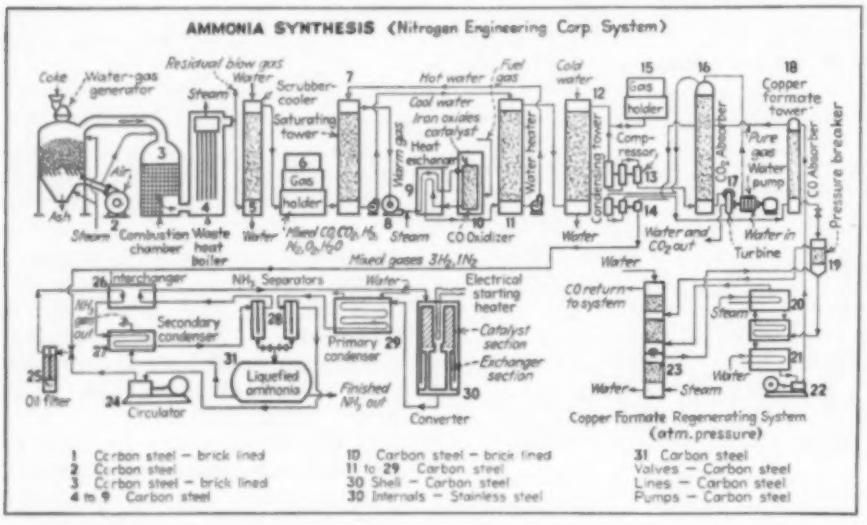
High-silicon iron's value is not limited by temperature, concentration, purity of acid or aeration. In the production of acetic acid by the destructive distillation of wood and

extraction with ether or other solvents from the crude pyroliqueous liquor, it is used extensively.

Stoneware is used principally in two manufacturing processes: (1) the fermentation of ethyl alcohol to form acetic acid and (2) in the manufacture of acetic acid by reacting calcium acetate with sulphuric acid.

Lead is moderately corroded by acetic acid solutions and is not generally recommended for handling either dilute or glacial where there is agitation, aeration or high temperature. This rules out lead except as a storage medium where there is slight possibility for removal of the lead acetate film through agitation of the liquid. Lead-lined tanks and vats have given good service in many cases where glacial acid has been stored. Precautions to be taken here are that the tanks be closed to exclude circulating air.

Rubber linings are used on a limited scale. Discoloration is a factor when using rubber. Some chemical plants use Saran tubing for siphons and short pipelines, but it does become brittle at elevated temperatures. Teflon has given excellent service as valve stem packings in acetic acid vapor at high temperatures. Among the other materials that are in use are Karbate, glass-lined steel, neoprene, wood, and tantalum.



Equipment and Construction Materials for . . .

Ammonia

PRODUCTION and handling of ammonia causes few problems of a corrosive nature. In the ammonia synthesis from water gas by the Nitrogen Engineering Corp.'s system, a modified and improved Haber-Bosch system, carbon steel is used almost throughout. In a few instances the carbon steel is protected from high temperatures by a lining of fire brick such as in the case of the water gas generator, the combustion chamber and the carbon monoxide oxidizer. Stainless steel is limited to the internal parts of the converter. For this purpose a low-carbon 18-8 stainless steel is used.

In the case of ammonia synthesis from natural gas used in several new plants, the sulphur-free gas passes from scrubbers to a reformer furnace. It enters the top of the furnace and flows downward through tubes surrounded by hot gases as in a steam boiler economizer. These tubes are 25 percent chromium and 20 percent nickel steel. And as in the case of the above process the converter contains stainless steel parts.

In the Claude process which operates at the high pressure of 1,000 atm., the gases pass through a number of high alloy (chromium, 12 percent; nickel, 60 percent; tungsten, 2 percent; iron, 25 percent; carbon, 0.35 percent) converters in series.

The Casale system is characterized chiefly by the design of the converter and condenser wherein some of the ammonia is left in the recirculated gases to temper or slow down the initial reaction in the catalyst chamber. Also, the entering gases are passed down in contact with the outside wall of the converter in order to keep its temperature below 400 deg. C. and thus to eliminate the expensive nickel-chromium-tungsten alloy used in the Claude system (Shreve, N.R.; "Chemical Process Industries," 1st Ed., p. 402, McGraw-Hill Book Co., 1945.)

The ammonia synthesis plant of Consolidated Mining and Smelting Co. at Trail, B. C., uses the process developed by Giacomo Fauser of Italy. The process employs an electrically controlled converter at 200 atm. and 500 deg. C. and works on electrolytic hydrogen generated in a special cell. Claude liquid air units supply the nitrogen. In this plant, gas from the sixth stage of the compressors passes through an oil separator into a common header between the compressors and thence to the precatalyst group for purification. With electrolytic hydrogen practically the only impurity is oxygen. The purification is effected with copper Raschig rings in a nickel steel column.

The converters or catalyst chambers are made of nickel steel. They are heated electrically during the start of operations by iron heating elements arranged in a spiral around the converter. (See *Chem. & Met.*, Nov. 1931, pp. 626-631.)

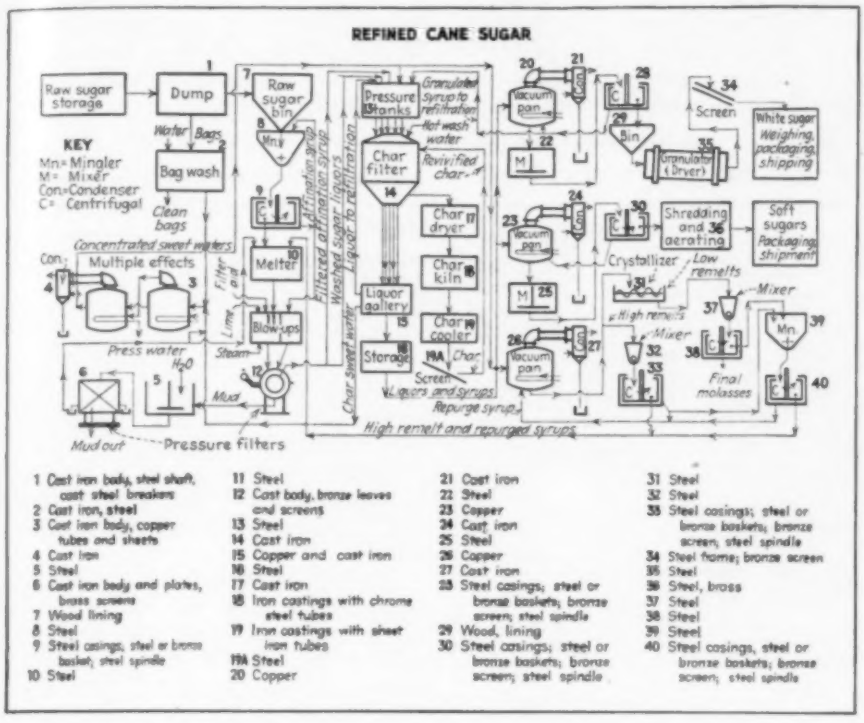
General Uses

Such equipment as cast iron or steel reaction kettles, evaporator bodies, pumps, stills and filter presses may be used for handling ammonia and ammoniacal solutions. One exception is a condenser where Type 304 stainless steel is used to protect against corrosion on the water side of the exchange.

Aluminum is not seriously attacked by ammonia. A thin protective layer builds up on the aluminum surface after exposure to ammonia. This layer prevents appreciable further attack. Aluminum tubing for ammonia in refrigerating units has given good service, while aluminum storage vessels, spray equipment and molds are widely used in contact with ammoniacal rubber latex solutions. In byproduct coke plants aluminum bubble towers are used for ammonia recovery so as to avoid corrosion from the hot ammoniacal sulphide bearing liquor. It has been reported that compressor rings of phenolic laminates are superior to cast iron rings in ammonia processing equipment.

Inconel is resistant to anhydrous ammonia and ammonium hydroxide solutions under a wide range of conditions. Nickel and Monel are resistant to anhydrous ammonia as used for refrigeration. In aqua ammonia Monel resists solutions containing up to 3 percent ammonia at atmospheric tem-

peratures; the limiting concentration of ammonia for nickel is 1 percent. "K" Monel is much more resistant than Monel and nickel to attack by stronger ammoniacal solutions. A few ammonium compounds, especially strong ammonium hydroxide, have been found to have a deleterious effect on Saran pipe.



Equipment and Construction Materials for . . .

Cane Sugar

COPPER, steel and cast iron have been used for decades in contact with liquid sugars. The serviceability of those metals is evidenced by the fact that there are now in operation many vacuum pans, liquor tanks and bone char filters with ages ranging from 50 to 80 years. In recent years many changes have been made in processing sugars; new products have been developed, and changes in construction, as well as new types, of equipment have created new problems in metals. Each refinery has its own variations of processing and its own theories on metals. The result is that several metals indicate good service but have not been in service long enough or in sufficiently wide variety of operating conditions to warrant full approval.

Tin, zinc, copper, stainless steel, aluminum and Monel are satisfactory in contact with liquid sugars. As far as is known, any metal may be used except lead, which is barred both voluntarily and legally. The questioning of many experienced refiners reveals no instance of the purity of the sugar being affected by metals. Considering the frequent routine tests made by government agencies and large food corporations, the evidence is quite convincing.

Very little research has been done on sugar corrosion and the behavior of alloys is so unpredictable that values can be determined only by test. The addition or change of a small amount of alloying metal may mean success or failure. In one special process, where corrosion was above normal, all forms of copper, including Monel, were unsatisfactory except one alloy with a copper content of 96 percent. This same alloy failed when used in another process where the corrosion was less than normal. In one process an aluminum alloy was used and immediately turned black; another alloy of the same metal was satisfactory. Both alloys had an aluminum content of 98 percent and the same three alloying elements. The difference in the result was caused by changing the relative proportion of the three minor elements by less than a percent.

Some metals may appear very desirable in specimen testing but lose some of their corrosion resistance in fabrication. The bottom screen in a bone char filter, consisting of a stainless steel perforated screen backed with a stainless steel wire screen, seems to be almost indestructible after a few years' service. During the washing of the filter the screen is subjected to waters containing a varying combination of organic salts. This same screen was tried in place of bronze screen in the basket of a white sugar centrifugal machine where the corrosion is much less severe. Due to its greater strength the stainless steel perforated screen was far superior to the bronze perforated screen. Within three months, the stainless steel wire screen was badly cracked with pieces of wire from ¼ in. to 1 in. in length falling out. This failure was attributed to corrosion fatigue. While the corrosive agents were greater in the char filter, the stresses, mild in both cases, and the temperatures, around 210 deg. F., were constant for long periods of time and seldom exposed to the atmosphere in the filter. In the centrifugal machine, the stresses varied from maximum to minimum every three minutes and it was as frequently exposed to the air.

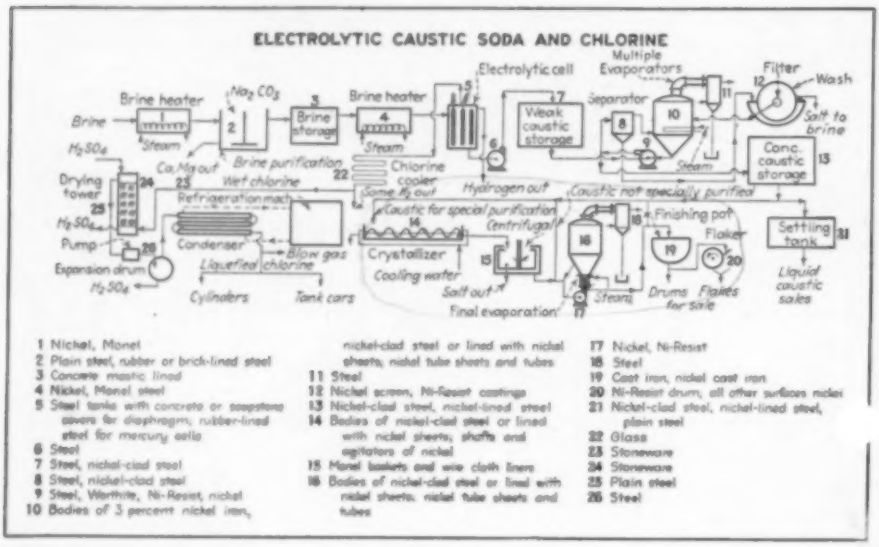
Scaling, confined generally to steel and cast iron, causes minute black specks in the sugar which, while not harmful in any way, might be revolting to a customer if he should find one in a piece of clear candy. Specks can not be completely eliminated so they are a constant irritation to the refiner who does his utmost to keep them at a minimum.

The above discussion has been of metals completely submerged in sugar solutions. A much more corrosive action occurs when vapors are present in an inclosed vessel. The modern trend is to inclose such equipment as liquor tanks and blow-ups, which from time immemorial have been emitting vapors causing a mild corrosion of structural steel and destroying paint. Refineries have tried many alloys but there is little agreement in results and all are seeking better materials.

Vapors arising from bone char processes are strongly corrosive. Those coming from the kilns and dryers are not corrosive if their temperatures are maintained above the dew point. Cast iron retorts in kilns have been superseded by thin wall retorts of 16 percent to 18 percent chrome steel. The only corrosion of these retorts comes from fuel combustion gases and is not too harmful if the carbon content of the metal is below 0.1 percent. Char

waste water contains some sulphur but practically all of that element flashes off in the open gutters in the liquor gallery.

There are many cast iron and steel bodies in the industry that have been in service for many years and have corroded to the point where they will have to be replaced in a few years if further corrosion is not prevented. This state of affairs offers quite a field for protective coatings and many tests are being made. Care must be taken to avoid coatings that contain elements that should not be used in contact with food. Some experimental programs have been prolonged because specimen tests were misleading. In some isolated cases, more expensive coatings have lasted longer but not sufficiently to warrant the additional expense. Some expensive coatings will give a life of 8 to 10 years and with some patching will probably last 5 or 6 years longer. At the present time there is not sufficient field experience to indicate the most satisfactory type.



Equipment and Construction Materials for . . .

Chlorine and Caustic

CHLORINE and caustic soda are produced in electrolytic cells. Brine is brought to the plant by cast iron pipelines, while rock salt is delivered in railway cars and stored in concrete tanks. The salt is dissolved in concrete, rubber- or brick-lined steel tanks. At a German plant raw brine was stored in outdoor tanks made of steel lined with sheets of Oppanol (polyisolintylene) protected on the inside by a course of acidproof brick.

Tanks where brine is treated for precipitation of soluble magnesium and calcium sulphates are usually plain steel, or rubber- or brick-lined steel. It is reported that a German plant filtered the resultant slurry through polyvinyl cloth on wooden frames, while another filtered brine on its way to cell feed tanks through a paper medium. The paper had been in use since cotton became critical and had proved to be more satisfactory than cotton both in life and lower turbidity of the brine.

The temperature of the purified brine is raised in steel heat exchangers and the solution saturated with salt. It is then reheated to prevent salt precipitation in the distribution mains. The warm saturated brine goes to the cell through hard rubber lines and enters the cells through tantalum orifices.

In the case of the diaphragm cells, steel tanks with concrete or soapstone covers are used. To reduce the weight of covers, asbestos fibers may be added to the mix. Steel is used in the form of wire mesh screen on perforated sheet for the cathode. The anode is graphite treated with linseed oil or other impregnating material. In mercury cells, rubber-lined steel tanks are used. Most of the bottom is left unlined so that the electric contact with the mercury cathode can be established. The cover is rubber-lined steel, although sandstone was formerly employed. Natural rubber is said to have a longer life than GR-S.

Warm, moist chlorine from the cells is usually led through chemical stoneware pipe to rubber-lined mains. The rubber is reported to have a life of five years. It is cooled in a stoneware, glass-lined or rubber and brick-lined steel heat exchanger. The gas leaves the exchanger in stoneware lines.

Removal of the moisture is necessary. This is done in stoneware or acid-resistant brick drying towers by allowing sulphuric acid to come into contact with the gas in countercurrent flow. After drying, the gas passes through steel pipelines, traps and condensers to steel storage tanks. It can be handled in cast iron pumps and compressors. High-silicon pumps are used whenever sulphuric acid is present. The dry chlorine can be shipped in steel cylinders, single unit tank cars, multi-unit tank cars or other containers.

The caustic soda is piped to evaporators consisting of bodies fabricated from nickel-clad steel or lined with nickel sheets or, for low concentration, 3 percent nickel cast iron. The steam chests are made from nickel; downtakes are nickel, or nickel-clad steel; and tubes are nickel. The evaporators are equipped with high-velocity nickel, 30 percent nickel Ni-Resist or Monel circulating pumps.

The discharge containing 30-50 percent caustic passes to a nickel-clad settler or filter with a nickel screen where salt is removed. It may be shipped at this concentration or further concentrated. In the latter case the 50 percent solution is pumped to storage in a plain steel tank. It is then pumped to another evaporator and concentrated to 73-75 percent. This evaporator is all-nickel construction. As required it is pumped to plain cast iron pots and concentrated to anhydrous. The concentrated mass may be pumped to steel drums or over a steel chilled flaking wheel. The flaked caustic may be crushed, screened and packed into packages of various size flakes.

Caustic for the rayon industry must be of high purity and requires special treatment in special metallic equipment. In such a case the 30 percent caustic is pumped to a crystalizer. The body is generally nickel-clad in nickel sheet-lined steel. Shafts and agitators are nickel. The slurry passes to a centrifuge with nickel basket and wire cloth liner for removal of the salt from the mixture.

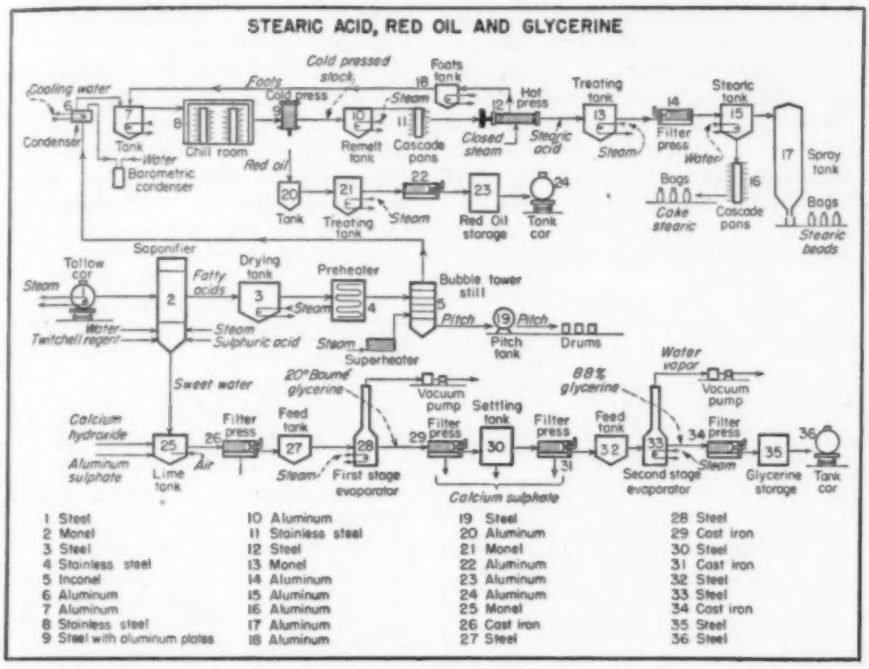
The caustic solution is then pumped by nickel, iron, Worthite or Ni-Resist pumps to an evaporator where it is

concentrated to 50 percent. This solution may be shipped to the rayon consumers in nickel-clad or lined containers.

When iron-free solid caustic is required it is concentrated in nickel cast iron pots, and flaked in equipment with nickel surfaces except for the cast Ni-Resist cooling drum.

It is reported that a German plant used cast iron pots of 11-ton capacity for producing anhydrous caustic. These pots were said to be unique in that they had strong tight-fitting tops and were operated at a finishing temperature near 440 deg. C. at a vacuum of 360 mm. Hg. Since adopting vacuum operation, pot life had been increased from 100 to 250 charges per pot. Some of the new pots had been installed in a fully suspended, dutch-oven type of setting which has also made for much longer pot life. In the United States large tube vertical evaporators of all nickel construction are used for the same purpose.

Caustic may be shipped in tank cars with bodies of nickel-clad steel, coils of pure nickel, and with fittings of Ni-Resist.



Equipment and Construction Materials for . . .

Fatty Acids

RECENT installations of fatty acid equipment have made extensive use of stainless steel, stainless-clad steel, aluminum, nickel and Monel. This has been particularly true in the case of stills, condensers, separators and pipelines.

There is a trend away from the use of copper and high-copper alloys, especially in the final processing of soap where possible contamination of the product with copper compounds is considered objectionable. However, copper is still used to some extent for bubble towers in stills for crude fatty acids.

The process which bids fair to dominate developments in this field is continuous, countercurrent high pressure, high temperature splitting. The concept of continuous hydrolysis is by no means a new one; however, commercial development was not practical until stainless steels were available as a material of construction and modern welding techniques were developed for high-pressure equipment. In general the equipment throughout the process is made of stainless steel where the fatty acids are at high pressure and temperature, but of aluminum where at low pressure and temperature.

Fatty acids used may be of either animal or vegetable origin, or both types may be used either separately or mixed in subsequent operations. They do not occur in a free state, but as complex fatty oils, consisting principally of glycerides, of the organic fatty acids. In the production of fatty acids from these glycerides, it is necessary to break down the glyceride into components, glycerine and fatty acids, a process referred to as "hydrolysis." Hydrolysis is generally done either with Twitchell reagent plus a small amount of sulphuric acid, or by sulphuric acid alone.

The fats which are used as the raw materials for fatty acids are shipped and stored in steel which, considering costs and availability, is probably the most satisfactory construction material. From the storage tanks the fats pass to acid (sulphuric) washing tanks which are lead-lined steel or wood. Some concerns prefer steel tanks, others wood, with lead linings. Both types have given complete satisfaction. No other lining materials have proved as satisfactory as lead.

This, however, is not true of the saponifying tanks which also employ copper linings. These tanks are either of wood or steel, lined with lead or copper. Although they are more expensive, copper lined tanks have been found to last longer. Still other companies believe it preferable to use unlined cypress tanks, replacing them as frequently as need be. It is true that they do not last as long as lined tanks, but there seems to be considerable question as to the economics involved. In any case of unlined tanks it is to be noted that only the best grade of cypress is worth using. The most recent installations have been fabricated from Type 316 stainless steel, Monel or nickel. When the fats are hydrolyzed in an autoclave copper and more recently stainless steel, nickel or nickel-clad have been used.

Filter presses are employed for a number of purposes. For the sweet water, ordinary cast iron plates are suitable, while for the fatty acids an aluminum and silicon alloy has performed satisfactorily. Tin covered copper for this purpose requires frequent retinning and is not satisfactory.

Evaporators of cast iron with copper tubes are very long lived. It is possible, however, that other types may be preferable. Stills for many years have been built of cast iron but, more recently, other metals such as stainless-clad steel, stainless steel, aluminum, copper, Monel metal, nickel and Inconel have been introduced. Very rarely do cast iron stills fail by being eaten away. Failure is generally by cracking.

Copper has been used for many years and with complete success for condensers, although in recent years aluminum, stainless steel, stainless-clad steel, nickel and Monel also have been used.

Three materials are used for the

slab pans, enameled iron, stainless steel, and aluminum. The latter two are better, but more expensive, so that enameled pans are generally used for the crude acid and aluminum for the finished product.

Both cold and hot presses are made of ordinary steel or iron. So far as is known, other materials have not been employed for this purpose.

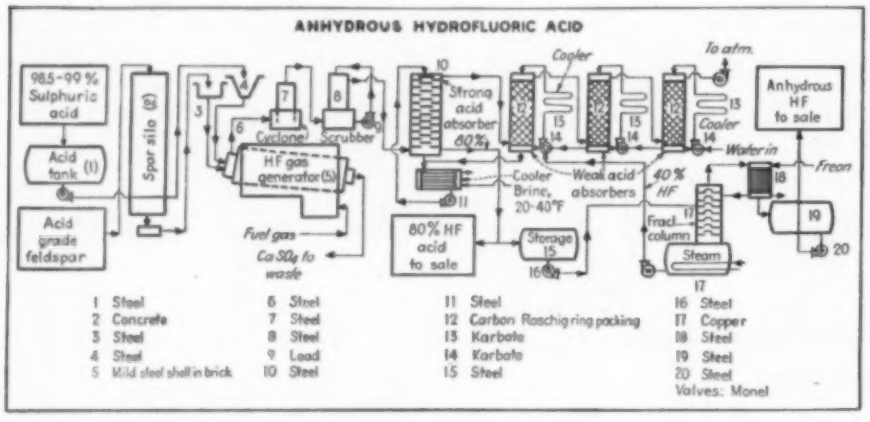
For remelting the acid cake, either aluminum or unlined cypress or wood, or steel tanks, lead-lined are used. There are engineers who contend that unlined cypress is fully satisfactory and it is certainly cheaper. The same situation holds in the case of the churns, where both lined and unlined tanks have been found suitable.

Red brass, bronze, copper, aluminum, steel, wrought iron, stainless steel, stainless-clad steel, nickel and Monel are among the materials used for piping and pumps. Both centrifugal and ordinary steam pumps are met, bronze being the most suitable material for the stock end. Aluminum pipe is probably the best in that it seems to have the least effect on the stock, although brass and copper both have proved very satisfactory.

Strangely enough, however, none of these metals seems to have worked out as a thoroughly satisfactory solution to the valve problem. Brass gate valves appear to be most used and, although the cause of considerable trouble, are generally thought to be as good as anything obtainable. Replaceable seats and gates are said to be worthwhile economy. Teflon seating disks have been used in globe valves and needle valves with excellent results since they resist erosion as well as corrosion in fatty acids at 400 deg. F.

Fatty acids may be safely stored in aluminum, nickel-clad steel, nickel, stainless steel, stainless-clad steel, cypress, cast iron or plain steel, depending upon the purpose.

These products are generally shipped in ordinary steel containers or in bags. Steel containers for oleic acid (red oil or white olein) must have linings of acid-resisting lacquer or plastic material. Not long ago in an article (*Chem. Eng.*, June 1947, pp. 104-108.) commenting on new developments in fatty acid processing the authors, C. J. Marsel and H. D. Allen, of Colgate Palmolive Peet Co. and New York University, contributed some helpful information on where special materials of construction are being used in the newer processes and plants.



Equipment and Construction Materials for . . .

Hydrofluoric Acid

PRODUCTION of hydrofluoric acid starts with fluorspar. It is stored in a silo and as required is transferred to steel, conical-bottom feed hoppers from which it is continuously fed to the still through an automatic scale and automatic feeder. Sulphuric acid of 98.5-99 percent is fed through a rotameter into the still.

Furnaces have shells of mild steel enclosed in a brick setting. The retort rotates slowly. Calcium sulphate residue is discharged continuously. Gas consisting of 70-75 percent HF is pulled off through a steel header at the feed end of the still at 250-350 deg. F. After passing through a cyclone dust collector to remove spar carryover, it is scrubbed countercurrently with condensed acid in a steel "scrubbed acid" tower provided with a bottom receiver tank. Sulphuric acid entrained in the gas is removed and recirculated or bled back into the still. The circulating pump is of lead construction. Temperature of the gas is lowered to 150 deg. F.

Gases from the still are pulled through into an absorption system consisting of a scrubber tower and overflow box, steel strong acid absorption towers and weak acid-absorption towers. Here the acid is concentrated to 80 percent. The entire system is operated by a fan or the vent. Final product is run to steel storage tanks.

Strong acid is refrigerated in a brine-cooled shell-and-tube exchanger. Weak acid is cooled in conventional water-sprayed Karbate coils. Strong acid towers are plate- and ring cascade-type. Strong acid pumps are of mild steel while those for acid under 80 percent are of Karbate. Part of the weak acid is stored in neoprene-lined steel tanks and fed back to the absorption system.

Strong acid is stored in mild carbon steel tanks from which it is pumped to the distilling column for concentration to anhydrous. This column is of copper construction. The copper reboiler is a kettle type with a bundle of copper tubes. Anhydrous acid leaving the still is condensed and cooled in a steel shell-and-tube condenser. The acid flows through steel lines to mild steel storage tanks.

Monel valves are used throughout this plant and have given good service. Copper, used for the column and reboiler, is as satisfactory as any available material.

Anhydrous vs. Aqueous

Like certain other acids, the corrosion rate of hydrofluoric acid varies greatly with concentration, in other words the anhydrous and aqueous acids demand different materials of construction.

It was found that because of its low corrosion rate, mild carbon steel was excellent for handling anyhydrous hydrofluoric acid and was the logical material for storage tanks, pipes, fittings, valves, and pumps. This conclusion has been sustained by experience during the past 12 years and it may be stated that steel tanks for storing HF have been in service for ten years and are in good condition today.

The shipping container problem has been solved by the use of steel. Apparently a protective coating forms on the surface of the steel, inhibiting further corrosion. This becomes a problem on valves in that it will cause these to freeze unless operated

at fairly frequent intervals. This is probably because the film cements moving parts together. By opening and closing valves at least twice each shift this operating difficulty may be avoided. Obviously, double-valving is required.

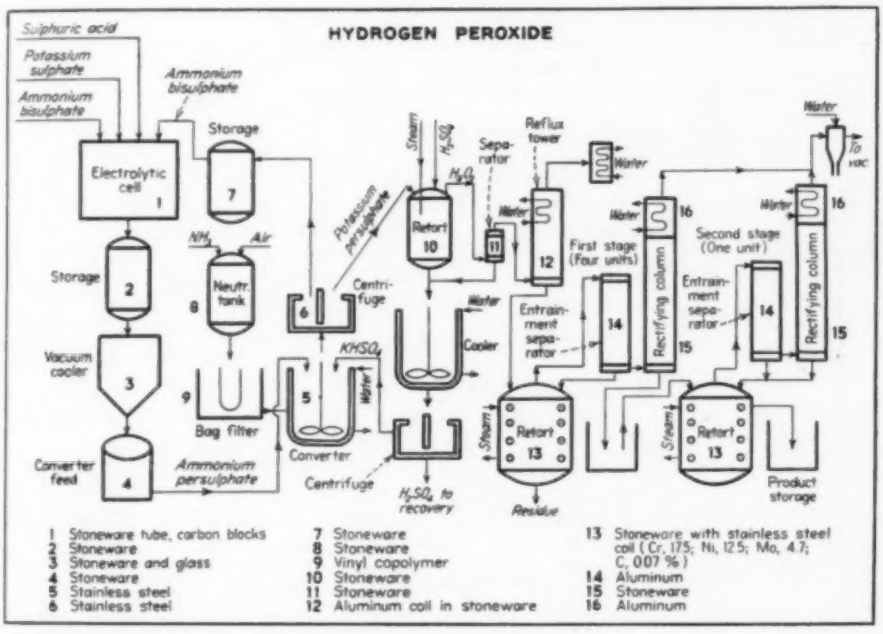
Some steel is more resistant to anhydrous hydrofluoric acid than others. A thoroughly deoxidized, dead melted, or milled steel in which the non-metallic inclusions are absolutely at a minimum is the ideal steel.

Experience with Monel has been satisfactory and it appears the best of all commercially available nonferrous metals for HF. Copper has been found satisfactory in various parts of the process. Under proper conditions it is a close second to Monel. It is, however, attacked in the presence of sulphur dioxide and oxygen and, where these are present in the anhydrous hydrofluoric acid, copper is unsatisfactory. Copper tubing is excellent especially where flexible connections are needed.

In addition to these metals, silver and platinum may be employed where the construction justifies. Platinum is probably the most resistant of all metals to HF and silver has a very excellent resistance in the absence of sulphides or appreciable quantities of sulphuric acid.

These recommendations apply to anhydrous hydrofluoric acid only, since steel is not satisfactory for HF below 60 percent. Copper, Monel, silver and platinum are resistant to the weaker acids except under the specific adverse conditions noted in the foregoing. Platinum and silver are particularly useful for small parts or for special members such as frangible disks.

Among the unsatisfactory materials of construction, probably the most readily attacked are those containing silica, such as glass, porcelain, enamelware, asbestos and certain silica cast irons. While lead is serviceable for acids below 65 percent, under normal conditions it is unsatisfactory for strong acids, especially anhydrous HF. Cast iron is more resistant to HF than lead but, probably due to silica inclusions, it is not a generally satisfactory material. Cast iron fittings will only last a comparatively short time before replacement. Among other materials found unsuitable for anhydrous HF are wood, which chars instantly; rubber which polymerizes and hardens, and most plastics.



Equipment and Construction Materials for . . .

Hydrogen Peroxide

DILUTE hydrogen peroxide can be made by any one of several processes. This dilute material can be converted to high-strength product by distillation. The methods for the production of low and high-strength peroxide shown in the accompanying flowsheet were taken from the report by Bretschger, Crewson, and Cushing ("German Hydrogen Peroxide Industry," PBI 7331, Apr. 1946 available from Dept. of Commerce) a condensation of which appears in *Chemical Engineering*, Aug. 1948, pp. 102-107.

Structural materials for handling peroxide solutions must be considered a special problem for each particular set of conditions. There are very few structural materials which are suitable for handling peroxide solutions under practically all conditions of manufacture, storage and use. In most cases, it is the effect on the stability of the peroxide solution which is the governing factor in choosing compatible materials.

Pure solutions of hydrogen peroxide are inherently very stable. When carefully purified and kept in clean unreactive containers, the rate of decomposition is extremely slow. Decomposition is accelerated by a wide variety of catalysts. Among the more active and commonly encountered catalysts are lead, manganese, copper and iron. Catalytic decomposition can, however, be inhibited by adding certain stabilizers to the solution.

Aluminum in contact with hydrogen peroxide is subject to two kinds of corrosion which must be inhibited or kept to a minimum. The dissolving of aluminum by hydrogen peroxide at a pH below the neutral point is inhibited by pyrophosphate. Localized pitting can be prevented by the addition of nitrates.

In order to prevent catalytic decomposition the aluminum should be 99.6 percent pure and free from foreign matter which may be embedded in the surface or included in the weld deposits. Aluminum which is 99.6 percent pure is being used for fabrication of shipping drums and storage tanks where contact with the hydrogen peroxide is over an extended period of time. For pipes, fittings, and tank cars where contact with the peroxide is for short periods, 99 percent aluminum is acceptable.

Chrome-nickel steels, such as 304, 347, 316 and 316 Cb are very resistant to corrosion by hydrogen peroxide under a wide range of conditions. However, these alloys have a mild catalytic effect on peroxide decomposition and are not generally recommended for long time storage of concentrated solutions. With dilute solutions (8 percent or less) stainless steel containers have been giving good performance.

Stainless steel is excellent for use with solutions of strengths as high as 50 percent (and possibly higher) when contact with the solution is of short

duration, e.g., in valves, pumps and pipelines. Stainless steel is also excellent for tanks and agitators for preparing dilute solutions and for tanks, vats and other equipment for bleaching operations.

In the non-metals group, glass and ceramic ware are widely used for production and storage equipment. They are not attacked and when properly cleaned they have no adverse catalytic effect. Hydrogen peroxide in strengths up to 35 percent is being packaged and shipped in glass carboys; ceramic ware is giving satisfactory performance in storage containers. Acidproof tile tanks and tile-lined concrete tanks have been used very satisfactorily for the preparation and storage of bleaching solutions and also for bleaching tanks and vats. Acid and alkali resistant cement is recommended for construction of these tanks.

Metallic tin is passive toward neutral and slightly acid solutions of hydrogen peroxide in concentrations up to 50 percent and possibly higher. It is corroded by alkaline solutions. Corrosion of tin by alkaline peroxide solutions is inhibited by the addition of sodium silicate. Tin is giving good performance in pumps, pipelines, tank linings, and some other pieces of equipment.

Tantalum is a suitable structural material for use with hydrogen peroxide under a very wide range of conditions as far as peroxide stability and resistance to corrosion are concerned. There may be conditions when its initial high cost is offset by satisfactory service over a long period of time.

Iron equipment is satisfactory only under special conditions and then only with quite dilute alkaline solutions.

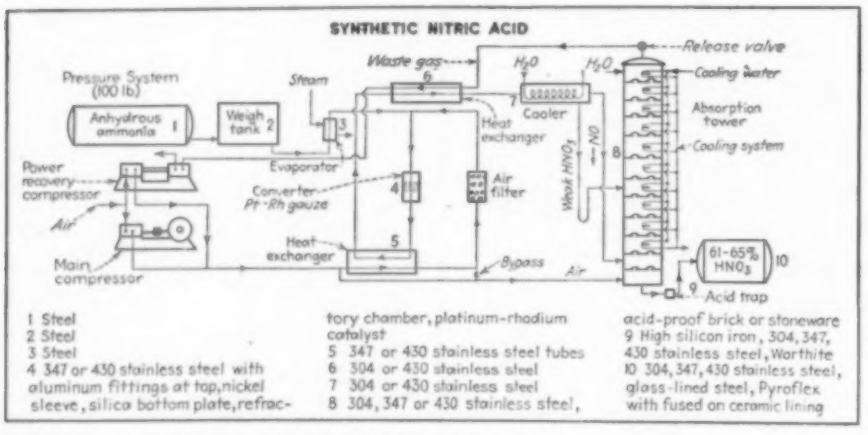
In lead equipment corrosion of the metal and catalytic decomposition are inhibited to some extent by addition of sodium silicate. Lead-lined tanks are being used successfully in the process for bleaching raw wool where sulphates are present to form lead sulphate instead of catalytically active lead oxide.

Copper equipment is unsatisfactory under practically all conditions. Monel metal, which contains 30 percent copper, is being used successfully for some textile bleaching operations.

Wooden tanks and pipes made o cypress and pine are fairly satisfactory for dilute peroxide solutions under many conditions. However, even dilute solutions, especially at high temperatures and high alkalinities, swell and soften wood fiber, which shortens the life expectancy of wooden tanks to four to six years. For most satisfactory use, wooden tanks should be constructed with a concrete or tile bottom.

Rubber hose has been used for dilute alkaline peroxide solutions, but the useful life of the hose is shortened to a period of one to two years. Natural rubber, as well as some synthetic rubbers such as neoprene, may be specially compounded for use with H_2O_2.

There are a few plastics which can be used for tubing and gasket material with dilute and concentrated hydrogen peroxide; among these are some of the polyvinyl chlorides, Teflon and polyethylenes. In general, coating materials are not satisfactory for use with concentrated hydrogen peroxide.



1 Steel
2 Steel
3 Steel
4 347 or 430 stainless steel with aluminum fittings at top, nickel sleeve, silica bottom plate, refractory chamber, platinum-rhodium catalyst
5 347 or 430 stainless steel tubes
6 304 or 430 stainless steel
7 304 or 430 stainless steel
8 304, 347 or 430 stainless steel, acid-proof brick or stoneware
9 High silicon iron, 304, 347, 430 stainless steel, Worthite
10 304, 347, 430 stainless steel, glass-lined steel, Pyroflex with fused on ceramic lining

Equipment and Construction Materials for . . .

Nitric Acid

NITRIC acid is produced by two processes: (1) ammonia oxidation and (2) from sodium nitrate and sulphuric acid, or as the latter process is sometimes known, the saltpeter process. However, the second method is almost extinct at this time in the U. S.

Ammonia Oxidation

Oxidation of ammonia and the absorption of the resulting oxides of nitrogen to form nitric acid is carried out in some plants at atmospheric pressure but it is now more general to carry it out under a pressure of 100 psi. The equipment and the materials of construction in both atmospheric and 100-lb. pressure plants are fairly similar, therefore no distinction will be made here.

The ammonia oxidation process is not complicated. It consists of mixing anhydrous ammonia with preheated air, passing the mixture over a platinum-rhodium catalyst, cooling, adding secondary air and absorbing the nitric oxide in water to form the acid.

The anhydrous ammonia is stored in steel tanks. As required it goes to a steel weigh tank and a steel evaporator where it is evaporated continuously using steam to supply the heat.

It is usual to preheat the air, and mix it with ammonia just before entering the catalyst chamber. Those parts of the system through which this mixture of gases pass should be fabricated of aluminum, nickel or silica in order to avoid decomposition of the ammonia.

The ammonia is oxidized with air in a Type 430 or 347 stainless steel converter by passing it through the catalyst gauze at 1,700 deg. F. The latter type of steel is equally as good or better. Generally when Type 430 is chosen, it is done because this type is more economical.

A typical catalyst chamber includes an aluminum fitting at the top through which the gas enters. The gas passes downward through a nickel sleeve and then through the catalyst. This consists of several layers of platinum or platinum-rhodium gauze held in a cylinder. It is closed at the bottom by a silica plate. The gauze cylinder is inclosed in a chamber of refractory material so that the heat which is liberated by the reaction may radiate to the catalyst. The catalyst chamber is enclosed in fire brick in the steel shell.

Gas (oxides of nitrogen) leaving the catalyst chamber passes through heat exchangers with tubes of Types 347 or 430 stainless steel. These preheat the air. The gas and excess air for the succeeding steps is further

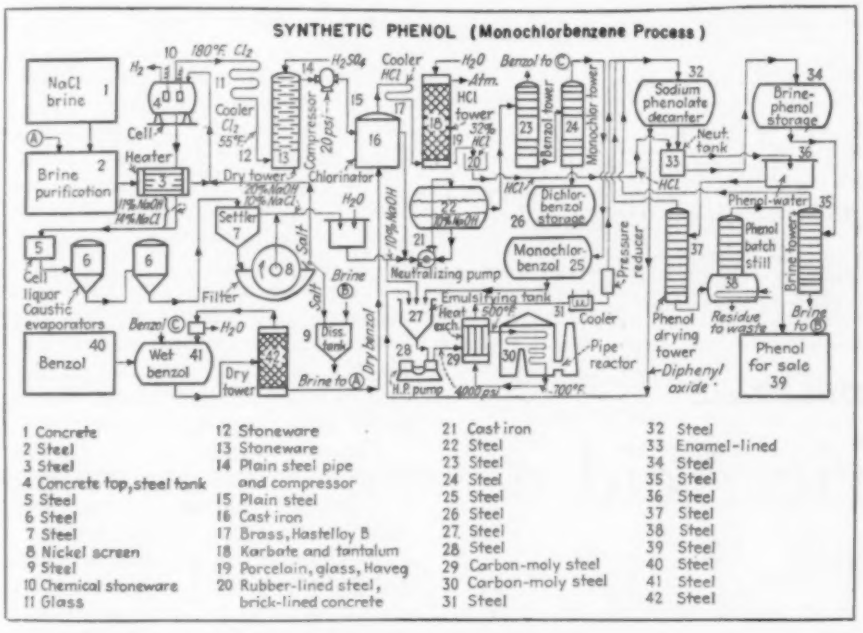
cooled in a water cooler and taken to the bottom of the bubble-cap absorption tower. Successive oxidations and hydrations of the nitric oxide are carried out with continuous water cooling in the tower of 304, 430 or 347 stainless steel. In very small plants these towers may be built of acid-proof stoneware or brick. The absorption towers may be packed with high-silicon iron, porcelain, stoneware or glass.

Acid is drawn off from the base of the tower through a trap of high-silicon iron, 430, 304, or 347 stainless steel or Worthite and is handled by outflow pumps of any one of these materials. From there the acid goes to storage tanks of any one of the three stainless steels, glass-lined steel or Pyroflex with ceramic lining.

The first synthetic nitric acid plant was constructed of the 15-18 percent chromium steel type 430 by Du Pont at Gibbstown, N. J., in 1926. Equipment in this plant was of riveted construction. Not long after this came the development of 15-16 percent chromium steel containing 0.10 percent maximum carbon. This modified Type 430 must be heat treated. It was found that this was the range of chromium content which would give the optimum combination of chemical and physical characteristics. All other elements being equal, the corrosion resistance of the straight chromium steels to the boiling nitric acid or other strong oxidizing medium is increased as the chromium is increased. Therefore, the adoption of a lower chromium content for the manufacture of nitric acid equipment meant sacrificing some corrosion resistance to obtain better shock resistance.

Gradually welded construction began to displace riveted construction so that by 1936 nearly all straight chromium steel equipment was fabricated by welding. During the war, nitric acid plants were made of both welded Types 347 and 430 (15 to 16 percent chromium steel). Also, all welded tank cars were constructed of these materials to transport by railway all concentrations of nitric acid.

We have now found out how to stabilize Type 304 stainless steel with columbium which is known as type 347. This steel has better corrosion resistance than 430 and can be welded and stress relieved. In wartime, plant equipment could be readily repaired without subsequent heat treatment. Therefore most future nitric acid will probably be constructed of the chromium-nickel steel, Type 347.



1 Concrete
2 Steel
3 Steel
4 Concrete top, steel tank
5 Steel
6 Steel
7 Steel
8 Nickel screen
9 Steel
10 Chemical stoneware
11 Glass
12 Stoneware
13 Stoneware
14 Plain steel pipe and compressor
15 Plain steel
16 Cast iron
17 Brass, Hastelloy B
18 Karbate and tantalum
19 Porcelain, glass, Haveg
20 Rubber-lined steel, brick-lined concrete
21 Cast iron
22 Steel
23 Steel
24 Steel
25 Steel
26 Steel
27 Steel
28 Steel
29 Carbon-moly steel
30 Carbon-moly steel
31 Steel
32 Steel
33 Enamel-lined
34 Steel
35 Steel
36 Steel
37 Steel
38 Steel
39 Steel
40 Steel
41 Steel
42 Steel

Equipment and Construction Materials for . . .

Phenol

THERE is both natural and synthetic phenol. The latter is made by any one of several processes. Due mostly to the mineral acids and alkalis used severe corrosion problems are encountered in all processes. Therefore a phenol plant consists of a great many different materials of construction.

The monochlorobenzene method in brief consists of chlorinating benzene to monochlorobenzene and hydrolyzing this intermediate to phenol. The chlorine and caustic soda required in the process are made in electrolytic cells. The latter is concentrated to 20 percent and separated from salt on a rotary vacuum filter with nickel screen. In a storage tank it is diluted to 10 percent and held for use in hydrolyzing the monochlorobenzene. Chlorine leaves the cell by means of a stoneware pipeline connected to a header. It is cooled in a glass heat exchanger and leaves through stoneware lines. The gas is then dried in a stoneware tower by allowing sulphuric acid to come in contact with the gas in countercurrent flow. After drying, the gas passes through plain steel pipelines to compressors. It goes directly through a steel pipeline to the chlorinator, a cast iron kettle. Here is comes into contact with benzene dried by distillation and pumped continuously to the chlorinator. The benzene is chlorinated. Every effort is made to keep the entire system dry so as to avoid corrosion and to prevent leaks.

Gases leave the chlorinator at 180 deg. F. and are cooled in a shell and tube heat exchanger. Brass and Hastelloy B have been found by experience to be more satisfactory than plain steel, for the latter is more apt to foul up on the water side and thus lower the heat transfer rate. Cooled gases go to a Karbate-tantalum absorber where they are absorbed in water to form 32-33 percent hydrochloric acid employed to neutralize sodium phenolate in the formation of phenol.

Acid is stored in either rubber-lined steel tanks or in concrete tanks lined with brick and sulphur-base cement. For acid lines from the absorber to the storage tanks procelain, glass and Haveg have been found to be satisfactory.

The liquid leaving the chlorinator is composed of unreacted benzene, monochlorobenzene and dichlorobenzenes. It is first neutralized with caustic by contact in a centrifugal high-speed pump, then it goes to the chlorinated products steel storage tank from which the clear layer is decanted and pumped continuously to the benzene tower. Chlorobenzenes are removed from the bottom of the column and are pumped to another column, the monochlorobenzene tower. The monochlor is distilled off and goes to a storage tank; the dichlors

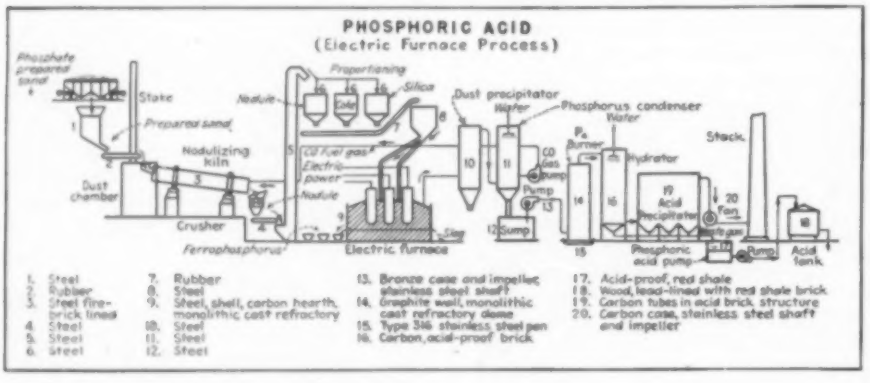
are drained off and sold as crude material. These two standard bubble cap towers operate together, the bottom product from the first feeding the second.

Monochlorobenzene and caustic are continuously added and mixed in the emulsifying tank. In the same tank is mixed the diphenyl ether which forms as a byproduct in the reactor. This mixture of the three goes to the high-pressure pump and is sent on its way at a pressure of 4,000 psi. In the carbon-molybdenum and heat-exchanger the temperature of the mixture is raised to 500 deg. F. It then goes to the reactor and the temperature is further increased to 700 deg. F. Formerly carbon-molybdenum steel was used but since the corrosion rate is high other materials are being tried with very considerable success.

Substantially all monochlor is reacted to sodium phenolate, diphenyl etller or high boiling residues.

From the reactor the mixture is cooled, pressure is reduced to atmospheric and the mixture goes to the decanter where the diphenyl ether is separated from the sodium phenolate. The former is recycled back to the heater via the emulsifyer. The sodium phenolate is continuously neutralized with the hydrochloric acid from the chlorinator in a glass-lined tank equipped with a stirrer.

There are two layers formed by this reaction, a brine layer and a phenol-water layer. The former contains sodium chloride and phenol. The phenol in the brine layer is recovered by distillation in a tower. This weak brine from the tower is filtered through sand beds to remove material in suspension and then made slightly acid. Next it is passed through activated carbon to remove traces of primary phenol and other organic material. Water-phenol comes off the top of the tower and goes to the sodium phenolate storage tank. The phenol-water goes to the continuous distillation tower. All water and the small volume of phenol go off overhead to the sodium phenolate storage tank. The bottoms product is the dry phenol and high-boiling residues. These pass to the batch kettle of a phenol tower which operates continuously until the batch kettle becomes full of residue when the batch kettle is drained. In other words the phenol still operates semi-continuously under vacuum. Pure phenol goes off overhead to the steel storage tank. It is later shipped in steel tank cars.



Equipment and Construction Materials for . . .

Phosphoric Acid

(Dry Process)

MATERIALS employed in the production and handling of the acid are numerous. Wood has long been a favorite for the fabrication of much of the equipment. Lead-lined wood or steel, and rubber-lined and covered steel are frequently employed. The linings are often protected by an acidproof brick lining. Stainless steel, carbon, concrete, high-silicon iron, and several high alloys such as Worthite, Hastelloys and Illium are used. Among the non-metallic materials often specified are Saran, Haveg, chemical stoneware and vitreous silica. The most recent development is the use of graphite combustion chambers for the burning of liquid phosphorus in the electric furnace process. Several have been installed in the past year or two.

In the production of phosphoric acid by the electric furnace method many special materials of construction are required for equipment. The concentrated ore from the washing plant and the crushed matrix from the mill are moistened and intimately mixed with finely ground coke before the mixture is carried by belt conveyor to the steel hopper above the moving grate of the sintering machine. Here the fuel in the mixture is ignited by an oil burner and as the bed moves forward on the machine, a down draft causes the balance of the coke to be consumed, thus fusing together all of the non-volatile particles in the mass.

The sintered product drops from the machine to a storage pit where it is allowed to cool before being ground and sized for furnace use. Fines are returned to the sintering machine, while the coarser product is automatically proportioned with the proper amount of fuel. This is accomplished by three continuous weighing conveyors. From these scales the mixture of sinter and coke is deposited on a rubber belt conveyor which delivers the mixture to hoppers high above the electric furnaces.

The charging of the sintered raw material and of the carbon electrode is automatically controlled in relation to electric current.

Phosphorus vapors volatilized from the burners of the furnace are condensed and run into sumps from which the phosphorus is pumped with water to storage tanks. These are of concrete construction.

The newest thing is the graphite combustion chamber for the burning of liquid phosphorus. It was developed by Tennessee Valley Authority. The chamber is a hollow tower with graphite block wall and base, and monolithic cast refractory dome. Blocks are joined by Asplit F cement, a chemical hardening resin cement. It has proved to be effective in resisting attack by the hot P_2O_5 vapor and metaphosphoric acid that in the past resulted in destruction of refractories and refractory cements alike. The chamber base is cupped in a shallow pan constructed of Type 316 stainless steel and is supported by wide flanged beams.

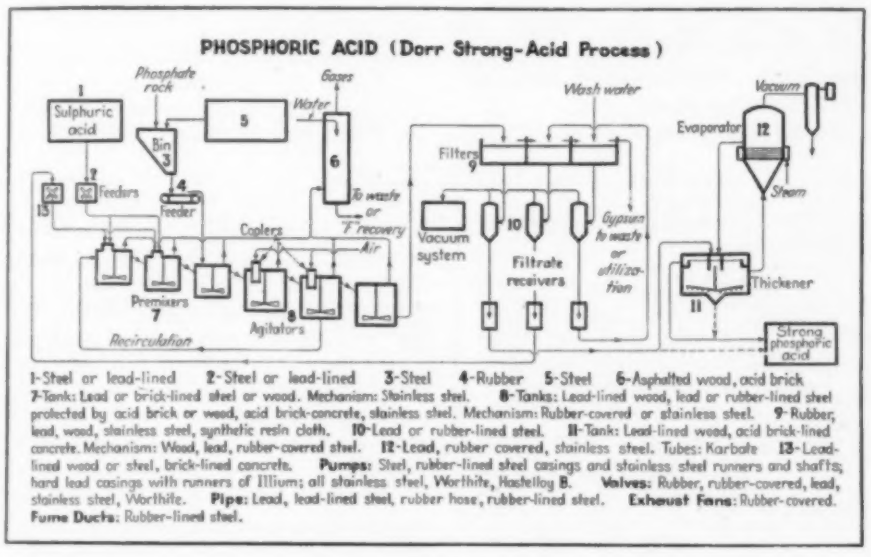
The phosphorus feed system consists of phosphorus tanks, a hot water storage tank, displacement water pumps, interconnecting piping, and a rotameter. The phosphorus feed tanks are filled from the phosphorus condenser sumps of the electric furnace units or from the phosphorus bulk storage tanks. The gradual build-up of phosphoric acid in the recirculated water is neutralized by addi-

tion of soda ash to prevent corrosion of the mild steel pipe and tanks and the all-iron cocks used throughout the metering system.

The hot gases from the combustion chamber are cooled in a graphite shell-and-tube cooler located between the combustion chamber and the hydrator. The cooler itself is made up of graphite tubes inclosed in a graphite shell. The gases enter one side of the cooler through a graphite stave duct, pass downward normal to the staggered water-cooled tubes, and pass out the bottom to the hydrator through a carbon-brick-lined steel duct.

Less spray water, above the fixed quantity needed for hyration of P_2O_5, is required for cooling to yield an acid of 82-86 percent content collected at 180-200 deg. F. (Almond, L.H., and Steinbiss, H.K., Graphite Combustion Chamber for Making Concentrated H_3PO_4, *Chem. Eng.*, Oct. 1948, pp. 105.)

The impure acid goes to lead-lined tanks and live steam is blown into it until it is heated nearly to the boiling point. This dilutes it to 75-80 percent. Sufficient sulphuric acid is added to precipitate the calcium as calcium sulphate, and to leave a small amount of SO_3 in solution. This last is quite important, as without this slight excess of sulphuric acid, phosphoric acid of this strength cannot be handled in lead. When a small amount of sulphuric acid is present, a dense scale of lead sulphate, insoluble in phosphoric acid, forms and protects the lead from further attack. After the acid treatment, finely powdered silica is added to combine with the hydrofluoric acid, and then hydrogen sulphide is blown into the acid until it is saturated. The excess silica, suspended matter, and the precipitate of calcium sulphate and arsenic trisulphide are removed by passing the acid through sand filters. (Badger and Baker, "Inorganic Chemical Technology," 2nd Edit., p. 131., McGraw-Hill Book Co., New York, 1941.)



1-Steel or lead-lined 2-Steel or lead-lined 3-Steel 4-Rubber 5-Steel 6-Asphalted wood, acid brick 7-Tank: Lead or brick-lined steel or wood. Mechanism: Stainless steel. 8-Tanks: Lead-lined wood, lead or rubber-lined steel protected by acid brick or wood, acid brick-concrete, stainless steel. Mechanism: Rubber-covered or stainless steel. 9-Rubber, lead, wood, stainless steel, synthetic resin cloth. 10-Lead or rubber-lined steel. 11-Tank: Lead-lined wood, acid brick-lined concrete. Mechanism: Wood, lead, rubber-covered steel. 12-Lead, rubber covered, stainless steel. Tubes: Karbate 13-Lead-lined wood or steel, brick-lined concrete. **Pumps:** Steel, rubber-lined steel casings and stainless steel runners and shafts; hard lead casings with runners of Illium; all stainless steel, Worthite, Hastelloy B. **Valves:** Rubber, rubber-covered, lead, stainless steel, Worthite. **Pipe:** Lead, lead-lined steel, rubber hose, rubber-lined steel. **Exhaust Fans:** Rubber-covered. **Fume Ducts:** Rubber-lined steel.

Equipment and Construction Materials for . . .

Phosphoric Acid

(Wet Process)

THE WET process, also known as the sulphuric acid method, consists of treating phosphate rock with sulphuric acid. One modification, formerly used, the weak acid process produced a phosphoric acid containing up to 22 percent but this has been almost entirely supplied by the strong acid process, (Wm. C. Weber, *Chem. & Met.*, Dec. 1932, pp. 659-662) which produces directly an acid containing up to 34 percent P_2O_5.

For information on corrosion problems in the wet process we have drawn on the article "Phosphoric Acid Imposes Severe Corrosive Burden," (*Chem. & Met.*, Oct. 1932, pp. 542-545) by Weber who together with the Dorr Co. have kindly reviewed and brought up to date that portion of this article dealing with the wet process.

Acid produced from phosphate rock by the wet process contains small percentages of sulphuric and hydrofluosilicic acids. This last is very troublesome, especially because of its volatile reaction products. Another complication is that the solutions are saturated with gypsum, and usually sodium and sometimes potassium fluosilicates with their steep solubility curves and difficult crystallization.

The rock is customarily ground dry with air separation although some plants have used wet grinding in pebble mills, using weak phosphoric acid as a grinding solution. In the latter case the shell, feed drum and discharge bell of the tube mill are constructed of iron or steel. All interior surfaces are protected by a rubber lining. Longitudinal hardwood strips are applied directly over the rubber lining and upon this layer of wood is laid the final lining of silica blocks set in acid-proof cement. For the grinding media are selected flint pebbles, while the manhole frame saddle and cover, and in some cases, the feed scoop are stainless steel. This construction, used in both strong and weak plants, provides, first, an impervious rubber lining to protect metal parts from corrosion, second, a layer of wood to act as a buffer between the silica lining and the rubber-coated shell and, finally, a lining of blocks to stand the abrasion and shock of the cascading charge and pebbles. It is preferable to use a rubber-covered drum type of feeder.

The agitation tanks may be of steel, wood or concrete. In the case of wood tanks these must be lead lined and the lead should be protected from abrasion and fluorine attack by wood or, preferably, a lining of acid-resisting brick. Steel tanks may be lead or rubber lined. With rising lead prices, light stainless steel tanks look increasingly attractive. Concrete tanks have been successfully lined with a double layer of acid-resisting bricks, set in acid-resisting cement. Steel is the preferred tank construction except where the other materials are cheaper. Tank covers may best be constructed of wood protected with asphalt. Fume ducts can be of wood but rubber-lined steel is preferable. The Dorr type of agitator, using combined air and mechanical agitation, was formerly used in weak acid plants but special designs of mechanical agitators using propellers or impellers are now preferred. Agitator shafts and impellers may be of rubber-covered construc-

tion or stainless steel. A number of factors affect the choice of the best design and materials of construction for the agitators.

Thickener tanks may be of wood, steel or concrete construction. If of wood or steel, they are lead-lined and provided with wood covers. Concrete tanks may be lined with acid-resisting bricks, set in acid-resisting cement. For very weak acids wood may be used for shafts, arms and braces of the thickener mechanisms, all joined together with bolts and fittings of special stainless steel, and with raking blades of plumbalun. For strong acids, lead-covered steel or even better, rubber-covered steel would be entirely satisfactory. Blades are stainless steel.

For filtering weak acid, as was often the case at the end of decantation plants, drum filters of the Oliver type were used. The drum or shell was of wood.

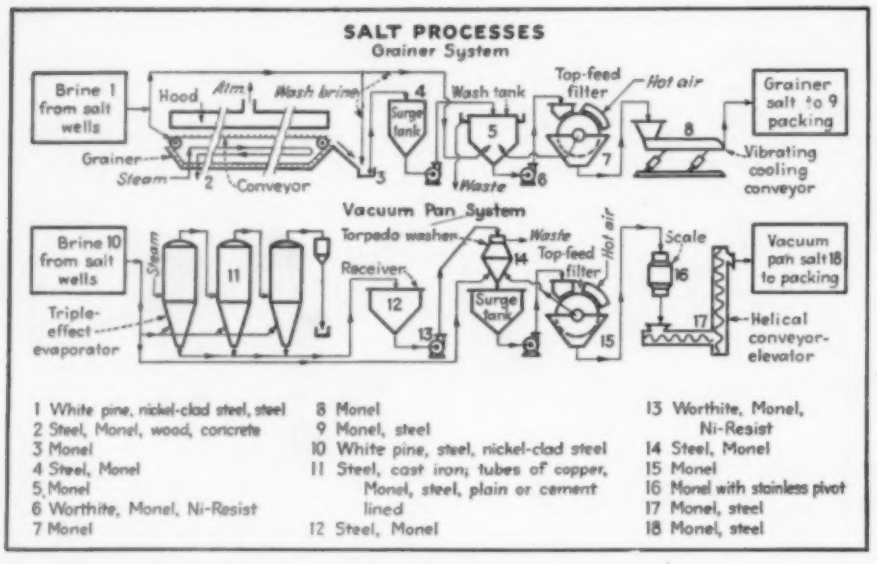
For the direct filtration of strong acid in the Dorrco process internal drum filters are used. The shell is lead lined with wood drainage boards and stainless steel clamp bars and bolts. The valve has a stainless steel seat and antimonial lead cover. Vinyon backing and filter cloths are used.

Present day designs employing this type of strong acid process prefer the use of horizontal type belt or table filters. The belt filters use rubber or neoprene belts supported on a stainless steel suction box and hard lead deck. The table filters are lead-lined steel with extruded antimonial lead backing grids and panel division strips. The cloths are held in place by asbestos rope caulking in hard lead grooves. The valves and valve covers are rubber-covered steel with a plastic wear plate. Both types of filters use synthetic filter cloths.

Centrifugal pumps are used exclusively for solutions. In the case of weak acid, hard lead casings with runners of Illium have been used successfully but all stainless steel construction or Worthite or similar alloys are most satisfactory and must be used for strong acid. This question of the proper choice of pump is vital to the success of a wet process plant.

Troughs and launders are, of course, simpler and more accessible than closed pipelines. Good phosphoric acid engineering suggests their use wherever practicable. Lead-lined wood construction is satisfactory for solutions, but an additional lining of abrasive-resisting brick should be used where sludges are to be handled or where concentrated fluorine fumes are present.

Piping for sludges should be rubber-lined and for solutions may be lead, lead-lined steel, rubber hose or rubber-lined steel.



Equipment and Construction Materials for . . .

Salt

SALT is refined by any one of several processes. The two most generally used are grainer pan and vacuum pan. Formerly it was customary to use iron and steel for much of the equipment. More recently the trend has been toward using Monel, Ni-Resist, Worthite and other special alloys. This has come about through realization of the savings to be made by use of corrosion-resistant materials of construction and by the desire for cleanliness and purity of food products, in which much salt finds its way.

In the grainer process the purified and filtered brine is pumped from white pine settling tanks or iron, which are sometimes protected with non-metallic coatings, by Worthite pumps to grainer pans. The long shallow pans are constructed of steel, Monel, wood, or concrete. The brine is heated by steam pipes of cast iron or steel. As the salt is crystallized it is brought to the front end by a steel or Monel rake and pushed into a Monel launder or trough. The salt slurry is conveyed by gravity or on a rubber belt to a surge tank, and is pumped by Worthite or Ni-Resist pumps to a tank in which the salt crystals are washed. The salt slurry is piped through plain steel, cast iron or Monel to a rotary vacuum filter and dryer. It is equipped with a Monel or stainless steel hood, filter cloth and winding wire. The dried crystals are passed over a Monel vibrating cooling conveyor. Following this the lumps are crushed or removed and the grains of salt sorted for the trade. Cylindrical wire-mesh screens, shaking screens, or bolters are used. Frequently Monel wire cloth is employed, although some plants prefer steel. The salt grains of various sizes are deflected by Monel distribution pipe to Monel or steel hoppers and thence to maple-lined bins. All parts of the weighing and packaging machinery which come in contact with the salt are constructed of Monel.

Vacuum Process

In the vacuum process the purified brine is evaporated in a multiple-effect evaporator of welded steel (maybe cement-lined), or cast iron body, steel tube sheets, and copper, steel or Monel tubes. Vapor lines are steel. Circulation is increased by the use of impellers of Ni-Resist.

Salt is drawn continuously from the evaporator in a slurry through the salt leg. The feed brine is introduced into the bottom of the leg so that the salt is washed by the incoming brine.

The slurry is pumped by a Worthite, or cast iron pump with Worthite or Ni-Resist impeller. Some plants use Monel shaft and fittings. It goes to a rotary vacuum filter for dewatering and drying. This filter is equipped with Monel screen and Ni-Resist grids. The dried salt leaving the filter is ready for screening and packaging.

Piping in a salt plant is plain steel and cast iron or, where greater purity is demanded, Monel metal.

Some plants use another device for separating the salt crystals from the brine. A steel, bronze, or Monel receiver and a continuous centrifuge with Monel baskets is used, in which case Monel hoppers and chutes are used to carry the wet salt from the conveyors to the centrifugals. The latter are equipped with Monel spreading belts. Where receivers and centrifugals are used the product goes directly to dryers in Monel screw conveyors, in a Monel-lined wood trough or on belt conveyors. The dryer is a rotary drum through which the salt passes slowly. Monel or nickel-clad steel is used in almost all dryers for the flights and linings.

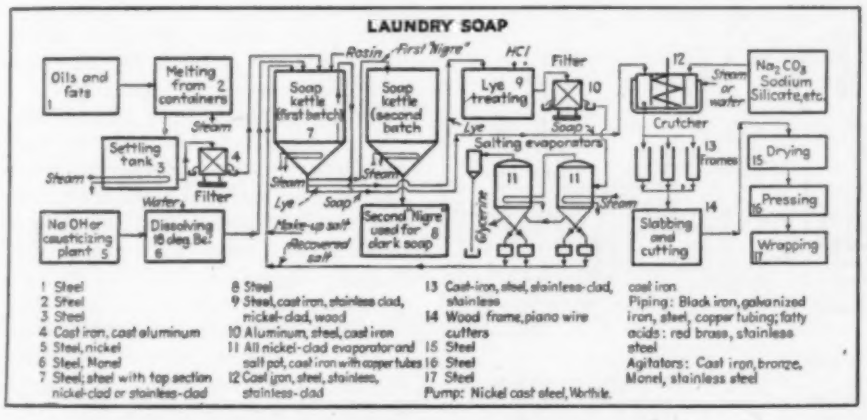
General

In the general handling of salt and brine cast iron and carbon steel are widely used for pumps, valves, tanks and piping. Corrosion generally occurs; however, its rate can usually be kept low enough to make their use practical, if iron contamination is not objectionable.

The lack of galvanic action between cast iron and Worthite has led to the use of the latter for internal parts in many pumps handling salt solutions or slurries. High-silicon irons have been successfully used for many years as materials of construction in applications involving sodium chloride solutions as the corrosive medium.

The principal uses for Karbate products in contact with brine solutions are those involving heat transfer equipment of all descriptions, including concentric, bayonet, cascade and shell and tube types.

Sodium chloride has very little effect on either natural or synthetic rubber and may be handled by either soft or hard linings. Selection of type of lining will be dependent upon service conditions, principally operating temperatures.



Equipment and Construction Materials for . . .

Soap

EQUIPMENT for the processes directly involved in the production of soap is mostly fabricated of carbon steel. This includes storage tanks for fats and oils, lye tanks, soap kettles, soap storage tanks and crutchers. In general, ordinary steel stands up satisfactorily in this service as soap builds up a protective film unless washed. Many manufacturers have not considered the additional cost of special corrosion-resistant materials as warranted. On the other hand, there is an increasing trend toward the use of stainless steels, nickel and its alloys, and other special materials, especially in the manufacture of high-quality white soap, such as white floating soaps, flake soaps and toilet soaps. Elimination of any possibility of iron contamination resulting from the use of steel equipment, or copper contamination resulting from copper or copperalloys avoids off-color soaps, development of change in odors and development of rancidity.

For yellow and laundry soaps some manufacturers have found rolled steel satisfactory for soap kettles, others prefer flanged steel plates with the courses made of nickel-clad or stainless-clad steel. These same manufacturers have found cast iron or steel plate have worn well for crutchers and agitators. Others are now using stainless steel.

For filters, cast iron or cast aluminum are used. All plants use cast iron salting evaporators, and some use copper tubes and tube sheets. For lye treating tanks wood, rolled steel, or cast iron is generally employed, but stainless-clad or nickel-clad steel is preferred occasionally. The pumps in laundry soap plants are fabricated from cast iron with Ni-Resist or Monel metal trim. Some plants prefer acid-resistant bronze for handling slightly acid conditions and high-silicon iron for strong acid washing. For soap, lye, and grease pipelines, wrought iron (all welded construction) is recommended. When piping fatty acids stainless steel is used. Other laundry soap companies use steel or galvanized iron for most pipelines.

Soap Plants in General

In the soap industry in general perhaps the most serious corrosion problems affecting the life of equipment occur in the reclamation of the salts and glycerine. Even in these processes, the demand for a high-purity product may place more emphasis on freedom from contamination than upon life of equipment. Salting evaporators are sometimes constructed of cast iron and copper tubes. Modern toilet soap factories use all nickel-clad evaporators and salt pots to keep iron and copper out of the salt which is reused in the soap kettle. Glycerine bleach tanks are made of nickel-clad steel and galvanized steel.

Some miscellaneous equipment has been fabricated from highly resistant metals. Stainless steel has been used for the tower construction for spraying soap powders. In some plants tile is preferred for this purpose. Crutchers, cutters, mixers, dies, pipelines, wrapping tables and much other equipment has been installed in Type 316 stainless steel, nickel or other resistant metals.

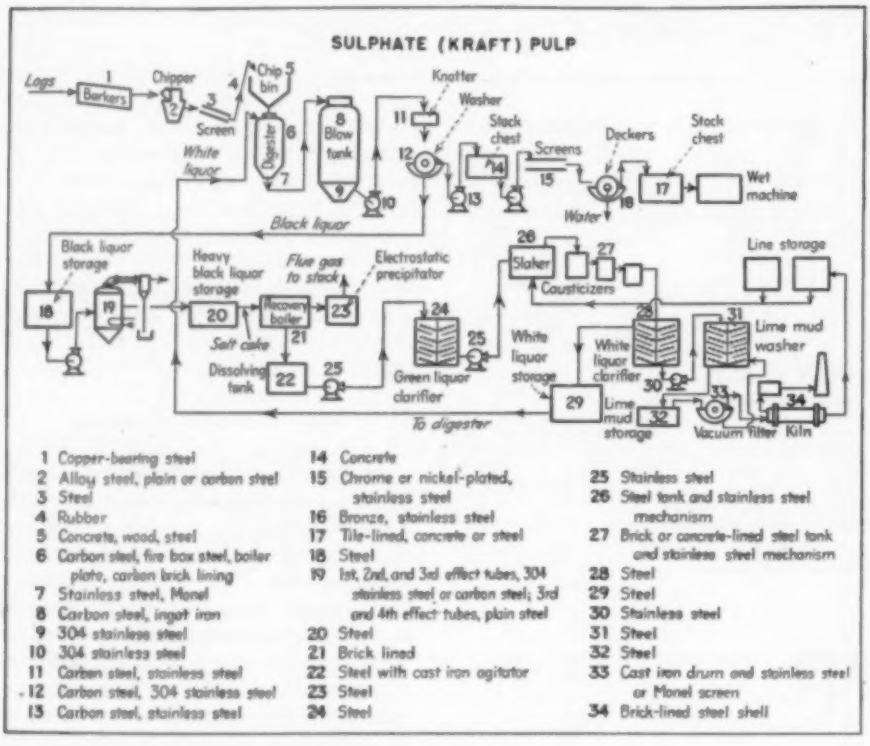
Soap cooling frames are frequently made of cast iron, steel plate, or lined with stainless steel, or nickel to prevent discoloration of the soap when it comes into contact with the sides of

the frames. Saran screen cloth, framed, makes drying trays for soap. Stainless steel is used for the hoppers and working parts of plodders which are employed for squeezing soap under high pressure into a solid bar of the required size and shape. Amalgamators which are used for incorporating perfume into the base, must be made of materials that are resistant to corrosion by perfumes and essential oils.

Drying is an important operation in the making of flake soap and conveyors are generally employed for this purpose. The use of stainless steel woven wire belts for conveying flakes through the dryer prevents discoloration. Spraying nozzles of Type 316 stainless steel are used on machines employed in the production of soap flakes. In these machines soap is forced under pressure through hollow forged cones fitted as a spray through fine holes drilled in the base of each cone. Stainless steel has proved in service to have the strength and resistance to corrosion necessary for this application.

For doctor blades on drying or chipping rolls several plants use cold rolled ¾-hard Inconel strip running against stainless steel and chromium plated rolls. Soap solutions in some plants are handled in Worthite equipment.

About the newest development in the soap industry is the several continuous processes for making soap. The process developed by the Procter & Gamble Co. (G. W. McBride, *Chem. Eng.* April 1947, pp. 94-97) is continuous countercurrent hydrolysis under pressure and at high temperature with a catalyst, followed by continuous distillation, neutralization, and finishing. In general, the equipment throughout the process is made of stainless steel where the fatty acids are at high pressure and temperature, but of aluminum where at low pressure. Fats are split to yield fatty acid and glycerine in a hydrolyzer, a 65-ft. stainless steel column. The fatty acids are continuously distilled under high vacuum in a stainless steel vessel.



Equipment and Construction Materials for . . .

Sulphate Pulp

THE BASIC procedures that are followed in sulphate pulping are as follows: Caustic soda and sodium sulphide are mixed with wood chips in a digester and cooked. The mixture is then blown into tanks known as diffusers or other vacuum washers and the cooking chemicals removed. The stock passes onto screens, then to a thickener, and finally into a stuff chest. From the stuff chest the stock passes to a screen where much of the water drains off and then it may or may not go to a bleaching unit. Finally, the stock goes to a wet press.

Wood to be pulped goes first to a copper-bearing steel barking drum, then it is passed to a conveying system where it is inspected. The wood is chipped. Alloy chipper knives in many cases are showing superiority over the plain carbon steel knives. Chips are carried on a steel conveyor to a perforated steel or wire screen. They fall into chip screens of riveted steel plate construction and are conveyed to and stored in concrete, wood or steel bins or silos.

Chips are charged into digesters where they are cooked. These are usually made of ordinary mild steel, fire box steel or boiler plate. Some digesters are lined with carbon bricks. Due to combined erosion and corrosion of plain steel in the conical portion of the digester, some mills have welded either stainless steel or Monel sheets into the lower parts of the cones.

For steam and liquor inlets and outlets on digesters most mills use ordinary iron and steel. Many mills use 18-8 or other stainless steels for nipples and nozzle linings. Type 317 stainless steel trimmed valves have proved satisfactory. Monel is also used to some extent for this purpose. Both of these metals and Ni-Resist are used for blow valves. For digester sleeves 18-8 stainless steel, extra heavy steel, and Monel are all reported as satisfactory.

Tubes for indirect heaters for the digesters are made from plain steel, Type 316 stainless steel, Inconel or Monel Type 316 is generally favored. Stainless steel has prevented trouble in the surface condensers used for condensing the blow-off steam from digesters.

When the cooking operation is completed in the digesters the stock is blown to blow tanks. These are made of ordinary steel or ingot iron but the conical bottom and perforated plates of these units are 18-8 stainless steel to prevent erosion and corrosion.

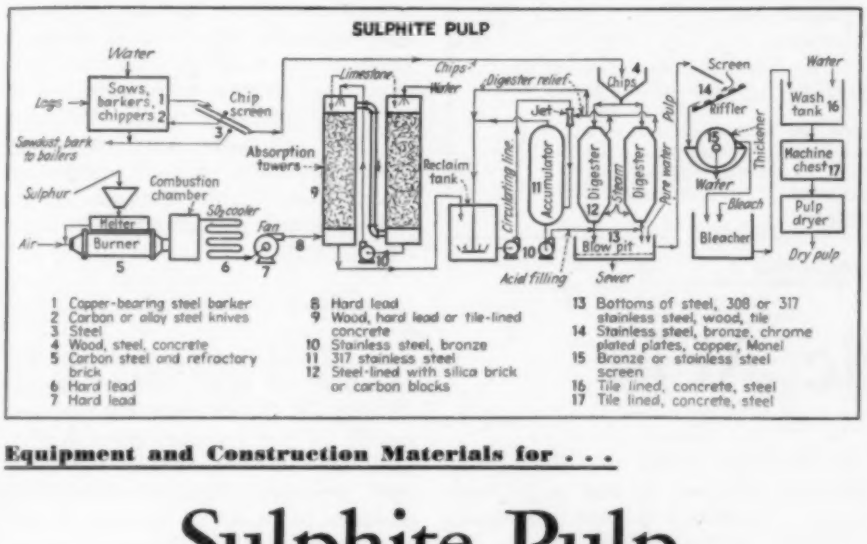
Pulp and liquor from the blow tank is screened in a knotter of plain or stainless steel construction throughout to remove knots. It is then passed over a rotary vacuum washer system with mild or 18-8 stainless steel screens to separate spent cooking liquor from pulp. The black liquor drops from each washer in the system through a vacuum leg to a tank in the recovery plant. The pulp is passed over rifflers and flat screens. In the case of plates for flat screens bronze castings are used. It is customary to chrome plate these plates, although some mills

have also used nickel plating. The latter is preferable to the chrome when hydrochloric acid is used to clean the plates, nickel having greater resistance than chromium to the acid. A newer development in flat screens is the use of thin stainless steel sheet reinforced.

Screened stock passes to deckers where it is thickened. The screens of these deckers are made of bronze or stainless steel. Thickened pulp goes to stock chests or stuff chests. These are frequently tile lined, concrete or steel. After the consistency of the stock is regulated, the stock goes to a wet press where it is made into wet lap for shipment.

In the recovery of chemicals from the spent cooking liquor is found one of the most corrosive conditions. For the first and second, and sometimes the fifth effect tubes of the black liquor evaporators Type 304 stainless steel has been found satisfactory. A few mills have chrome plated the steam side of the fifth effect tubes. Plain steel is satisfactory for the other effects. Some mills also are plain steel for all tubes with fair success. In many of the newer installations the tube sheets, lower body and top deflector of effects one and two are stainless clad. The pumps used to transfer the liquor between stages are stainless steel in some of the new mills. Others use ordinary carbon steel.

In the recausticizing plant some special materials are used for equipment construction. Unlined steel tanks are used for slaking lime in many mills. Others prefer tile, brick or concrete linings. The most recent installations consist of steel tank and stainless steel mechanism. The causticizers in the new plants are steel tanks with brick or concrete lining and stainless steel mechanism. The vacuum filters have cast iron drums and stainless steel or Monel screens. The centrifugal pumps are also stainless steel.



Equipment and Construction Materials for . . .

Sulphite Pulp

THERE are generally considered to be more corrosion problems in sulphite pulping than there are in any other pulp making process. Formerly, most equipment was fabricated from lead, copper, or copper alloys. While lead is still the preferred metal for sulphur dioxide gas coolers, much of the other equipment with the main exceptions of acid towers and tanks, digesters, accumulators and blow pits is stainless steel, Types 308 and 317.

The process commences with removal of the bark from wood to be pulped. It is removed in a copper-bearing steel drum. Cleaned wood is chipped. Alloy chipper knives in many cases are showing superiority over the plain carbon steel knives. Chips pass over a perforated steel or wire screen for sizing. Next they are conveyed by rubber belt conveyors to wooden or steel bins or concrete silos. They are charged into a digester where they are cooked with a mixture of calcium bisulphite and sulphurous acid.

Digesters for regular calcium base operations are steel, lined with silica brick. Type 317 stainless steel is successful for acid lines, relief lines, and the like, especially in connection with hot acid and digester circulating systems. Type 308 stainless steel has given excellent service for collector rings, screens and similar digester accessories. Valves and fittings which are in contact with cooking liquor are chrome-nickel steels. Relief cooler shells are lead and concrete and cast iron pipe. All bronze or copper alloys should be eliminated from the cooking system at elevated temperatures to avoid electrolysis which can give considerable trouble.

When the cooking of the chips is completed the contents of the digester are blown to the blow pit. Both cast iron and bronze have been used commonly for blow pipe on sulphite digesters. Ni-Resist also has been used. Probably the most suitable material for blow lines is stainless steel. This is particularly worthwhile where the pulp is for the rayon industry. The perforated bottoms used in blow pits and drainers are steel, stainless steel, wood or tile. The use of Types 308 or 317 stainless steel perforated bottoms and targets has been successful. In fact, stainless steel has proved to be superior to either acidproof tile or wood for bottoms, being non-plugging and less easily dislodged in service. Pulp draining and washing is facilitated.

As for blow-pit accessories; stock valves and save-all plates are 18-8 stainless steel, shower pipes of lead and bronze. Stock lines from pits to stock chests are of Type 317 stainless steel in some cases. Other mills are using wood-lined steel with good results. Blow valves and stems of stainless steel are satisfactory and avoid electrolysis due to dissimilar metals.

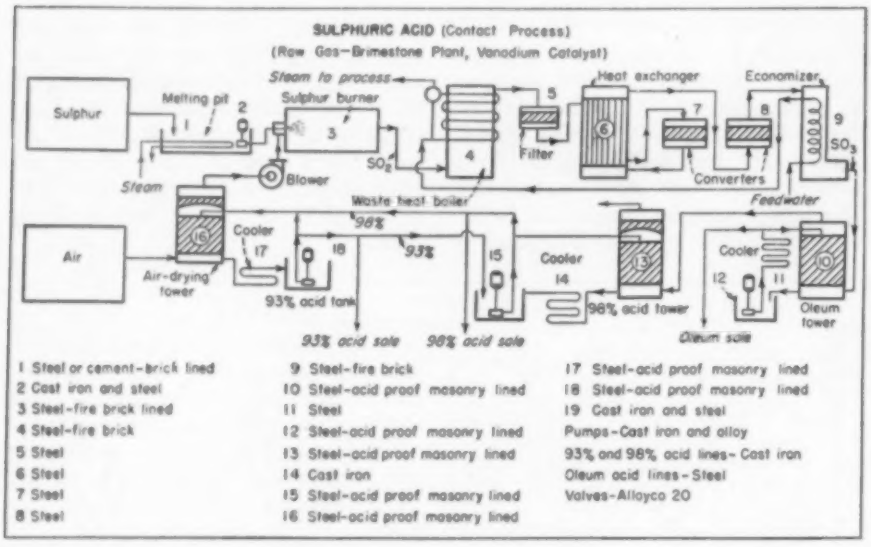
Pulp after washing is screened in a knotter of plain or stainless steel construction throughout to remove knots. The pulp is passed over rifflers and flat or rotary screens. In the case of plates for flat screens bronze rolled metal is used. It is customary to chrome plate the plates although some mills have also used nickel plating. A newer development in flat screens is the use of thin stainless steel sheet reinforced. Screen plates for the rotary screens may be copper, Monel or stainless steel, although the latter tends to become brittle and crack due to the cold wash.

Screened stock passes to deckers where it is thickened. The screens of these machines are made of bronze or stainless steel. Thickened stock goes to stock chests or stuff chests. These are frequently tile lined, concrete or stainless steel. After the consistency of the stock is regulated, the stock goes to a wet machine where it is made into wet lap for shipment.

The cooking liquor is made from sulphur which is burned in unlined carbon steel, rotary burners or in spray-type burners. The sulphur dioxide gas is cooled in antimony lead or tellurium lead pipes submerged in wa-

ter or over which water is allowed to flow. The lead is resistant to attack not only by sulphur dioxide and sulphurous acid, but also by sulphuric acid which is always formed to a small extent. A hard lead fan blows the gas into the absorption towers. These towers are wood or tile-lined concrete.

The gas passes to the towers where it reacts with the limestone and water. The cooking liquor then formed is pumped by stainless steel or bronze pumps through hard lead or stainless lines to the accumulator of Type 317 stainless steel. Valves and fittings in contact with sulphurous acid are made of lead, bronze or stainless steel.



Equipment and Construction Materials for . . .

Sulphuric Acid

IN THE production of sulphuric acid by the contact process, the strengths handled are 77.7 percent (60 deg. Be.), 93 percent and 98 percent acid. Temperatures are high. The two highest concentrations are not particularly difficult to handle, but the 60 deg. Be. acid is corrosive to many metals. In general, much of the equipment in a contact plant can be made of plain iron or steel. However, some few pieces require special materials.

Sulphur is melted in a concrete or steel pit. Coarse impurities are settled out. Some plants remove the fine particles by filtration. The filters are subject to attack by sulphuric acid formed by action of moisture on the sulphur during transportation of the latter. Corrosion is avoided by use of Type 316 stainless steel, porous carbon, or porous stoneware for parts of the filter which come in contact with the acid.

Molten clean sulphur is pumped into a brick-lined furnace through a spray nozzle. Here it is burned in predried air to form sulphur dioxide. The air for combustion is drawn from the atmosphere through a steel filter into the drying tower consisting of a steel shell lined with acidproof masonry and packed with spiral rings. Strong acid (93 percent) is circulated over the brickwork in this tower and removes the moisture in the air. Heat generated by dilution of acid with water vapor is removed in cast iron cooler sections. Acid is pumped over the drying tower and through the coolers by a high-alloy steel pump.

Hot gases leaving the sulphur furnace pass through a steel waste boiler in which they are cooled. Plants that do not filter the molten sulphur, in order to remove impurities, pass the cooled gas through a steel tray gas filter. The sulphur dioxide then enters a steel heat exchanger. Here the temperature of the SO_2 gases is raised to the required point for passing through the first layer of catalyst mass. The hot gas then passes through two layers of mass in the primary converter where partial conversion from SO_2 to SO_3 takes place. Next it is cooled in the steel heat exchanger before entering the secondary converter where further conversion takes place. The gas is again cooled before it enters the last layer of mass.

Hot gases leaving the converter are cooled before entering the absorption tower. This cooling is done in an economizer. Gas leaves the economizer at 450 deg. F.

The SO_3 is removed from the gases by scrubbing with 93 to 99 percent acid in a tower similar to the drying tower. Generated heat is removed by cooling the circulating acid in cast iron cooling sections. Acid is pumped over the tower and through the coolers by means of a high-alloy steel pump. Valves in the 98 percent acid line are made of high alloy steel.

Either 93 or 98 percent acid is withdrawn and diluted with water to 60 deg. Be. Since a large amount of heat is generated when diluting in this range, coolers and circulating pumps are provided to remove it. The cooler sections are made of cast iron and should not be used to provide acid of lower strengths than 60 deg. Be. since the lower strengths would cause excessive corrosion. Acid is pumped to a steel storage tank. Between storage and shipment it is handled by alloy steel pumps.

Lead Chamber Process

In the lead chamber plant the concentration of H_2SO_4 seldom exceeds 60 deg. Be. Aside from the corrosive nature of the low-strength sulphuric acid, the problem of selecting materials is further complicated by the presence of oxides of nitrogen at certain stages in the process. Chemical lead and acidproof stoneware are the materials that are most satisfactorily used in this case.

General Uses

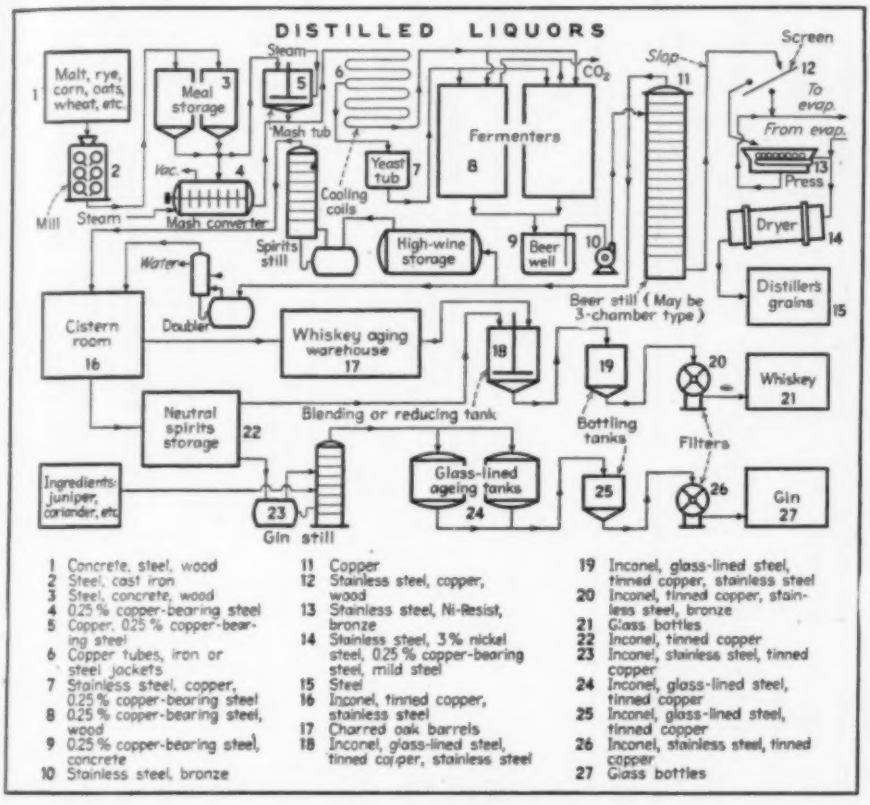
Lead satisfactorily resists cold acid of all strengths up to 95 percent and hot acid of all strengths up to 80 percent with temperatures up to 205 deg. C. For some purposes antimonial lead is used in preference to chemical lead on account of its greater strength.

Between 80 and 100 percent carbon steel and cast iron can be used, particularly at the higher concentrations. High-silicon iron has been successfully used for many years in applications involving sulphuric acid and solutions containing it. This alloy exhibits excellent resistance to all concentrations of the pure acid up to and including boiling temperatures. A limitation of high-silicon irons is their susceptibility to thermal or mechanical shock. However, if reasonable care is exercised, a long trouble-free life can be expected.

The high-alloy content of Durimet 20 imparts good resistance to this acid, especially at elevated temperatures and

higher concentrations. Chlorimet 2 and Chlorimet 3 alloys can be successfully applied to most of the severe acid services encountered in chemical plants. The stainless steel alloy, Worthite is used for many pumps and valves in the acid industry. R-55 alloy pumps are also favored.

Among the many other materials that are used in the handling of sulphuric acid and solutions containing this acid are chemical stoneware, carbon, graphite, impervious carbon, impervious graphite, and rubber and phenolic resin linings.



Equipment and Construction Materials for . . .

Whiskey

THE MODERN distillery is full of special materials of construction. Some few of the most troublesome problems will be discussed here.

Most distilleries are replacing wood with metal fermenters. The acidity present in fermenters causes more or less corrosion. Lactic acid is involved. Iron and steel fermenters seldom last more than ten years. The more modern installations are copper bearing steel. Copper or stainless-clad steel would be satisfactory but for price.

Since modern fermenters have attemperating coils, generally made of copper, hung on steel or brass rods, there is a possibility of electrochemical action. When copper-bearing steel is used, the copper tends to hold the oxidized iron on the surface of the steel, thereby tending to produce a film which greatly retards the corrosion rate.

There are various types of stills used for the production of different whiskies but practically every one is made of copper. This metal seems to satisfy the demands for resistance to corrosion, ease of fabrication, and good heat transfer.

It is necessary to avoid contamination of the whiskey with copper, iron or other metals because these metals will form precipitates after the whiskey is aged and bottled. Inconel, tin, glass, and stainless steels are good construction materials. Special rubber hose may be used for pipelines. This problem of metal contamination must be avoided in the still receiver tanks and in the bottling plant because 1 ppm. of iron will darken whiskey and cause a precipitate. Other metals have the same effect at high concentrations.

After the distillation process has been completed, the spent wash is pumped to the dryer plant for the recovery of the grain solids which are sold as stock feed. The process may start with the screening of the spent wash to recover the solids. Perforated copper sheets or woven wire screens are satisfactory if they are structurally strong enough. Stainless steel is satisfactory for this purpose; in fact, it is the most valuable material in connection with this step in the operations. The screen frames may be of wood but even cypress or cedar soon falls apart under the conditions encountered.

Dewatering presses not only have to handle screened material at 200 deg. F., but are generally surrounded by vapors saturated with the acid from the material. All parts of these presses should be made of stainless steel and bronze, with castings of austenitic cast iron such as Ni-Resist.

Dewatering presses made of ordinary cast iron and steel will generally not last more than two years under a 24-hr. per day operation. Where stainless steel is not economic, air duct and stacks made of Transite seem to be about the best solution. Since fans are not obtainable in Transite, the most satisfactory material available seems to be 18-8 stainless steel.

Although 5 percent nickel steel will not stand the vapor handling, it is satisfactory for the shells of the rotary drum dryers. In the dryers the moisture content of the feed is low and the moisture in the air is generally considerably below the saturation point. Possibly for the same reason, the steam tubes of these dryers may be of ordinary mild carbon steel with a life expectancy of eight to ten years.

Centrifuges, when used, should have stainless-clad steel shell and stainless steel or bronze baskets, the former being the more desirable.

Evaporators handle the thin effluent from the spent mash after it has passed through the steps of screening and/or centrifuging, concentrating this liquor to about 25 to 50 percent solids.

Cast iron evaporator bodies are used because of the high cost of other materials. An extra-heavy cast iron shell can be secured at a much lower first cost than any other material. Copper steam chests, however, are a good investment. Silicon copper or stainless steel would be better construction materials for evaporators, particularly for high velocity evaporators. Anyone who has tried to use ordinary steel or iron piping for evaporator service on the material discussed here, has found that all such piping must be replaced with brass, copper, or some other non-corrosive material after 12 to 18 months.

Directory of Materials

For the 13th time *Chem & Met* has polled the manufacturers of corrosion resistant materials of construction. As always they have responded nobly; it has taken 13 pages to list all the metals, carbonaceous materials, cements, ceramics, rubber products and plastics available to the corrosion engineer. To the usual data on each product—name, manufacturer, description—there has been added this year a fourth class of data, most important applications. Under this heading each manufacturer has been asked to list the half dozen chemicals that account for the bulk of application for his material. These are intended to suggest, in a general way only, the field of greatest usefulness for the several materials. Warning: There is no implication, where, say, sulphuric acid is listed, that the material in question will withstand any temperature or concentration of the acid. Such limitations exist in every case; they have been omitted here because the intent has been general suggestion, not precise definition, of corrosion resistance.

Materials	Manufacturer	Description	Most Important Applications
METALS & ALLOYS			
Acipco Stainless	Amer. Cast Iron Pipe Co., Birmingham, Ala.	Various standard stainless steels.	
Admiralty	Generally available. *	70 Cu; 1 Sn; 29 Zn	Fresh and salt water.
Admiralty, Antimonial	Chase Brass & Copper Co., Waterbury, Conn.	71 Cu; 27.95 Zn; 1 Sn; 0.05 Sb	Petroleum compounds, corrosive waters; salt brines.
Admiralty, Arsenical	Generally available. *	71 Cu; 28 Zn; 1 Sn; 0.04 As, Sb or P	Fresh and salt water; distillery liquors; petrol. prods.
Admiralty, Phosphorized	Scovill Mfg. Co., Waterbury, Conn.	71 Cu; 28 Zn; 1 Sn; 0.03 P	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; weak mineral acids.
Advance	Driver Harris Co., Harrison, N. J.	55 Cu; 45 Ni	
Alchrome 3	Wilbur B. Driver Co., Newark, N. J.	Fe; 20 Cr; 3 Al	
Alchrome 6	Wilbur B. Driver Co., Newark, N. J.	Fe; 20 Cr; 6 Al	
Alcoa 99.6 Al	Aluminum Co. of Amer., Pittsburgh, Pa.	99.6 Al	Foods; hydrogen peroxide; nitric acid; fermentation chemicals; beer and bev.; essential oils.
Alcoa 2S	Aluminum Co. of Amer., Pittsburgh, Pa.	99.2 Al min.	Alcohol; naval stores; syn. resins and fibers; aldehydes; explosives.
Alcoa 3S	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 1.2 Mn	Atmosphere; foods; short chain aliphatics and their anhydrides; nitric and fatty acids; ammonium nitrate; esters.
Alcoa 4S	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 1.2 Mn; 1 Mg	Atmosphere.
Alcoa 52S	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 2.5 Mg; 0.25 Cr	Atmosphere; foods; alcohols; naval stores; syn. resins and fibers.
Alcoa 61S	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 0.25 Cu; 0.6 Si; 1 Mg; 0.25 Cr	Atmosphere; alcohols; ammonium nitrate; petrol. prods; refrigerants; sulphur and hydrogen sulphide.
Alcoa 63S	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 0.4 Si; 0.7 Mg	Atmosphere; water; short chain aliphatics and their anhydrides; fatty acids; petrol. prods.
Alcoa Alclad 3S	Aluminum Co. of Amer., Pittsburgh, Pa.	3S clad with 72S (Al; 1 Zn)	Water; naval stores; sulphur and hydrogen sulphide.
Alcoa Alclad 4S	Aluminum Co. of Amer., Pittsburgh, Pa.	4S clad with 72S (Al; 1 Zn)	Atmosphere; water; sulphur and hydrogen sulphide.
Alcoa Alclad 53S	Aluminum Co. of Amer., Pittsburgh, Pa.	53S (Al; 0.7 Si; 1.3 Mg; 0.25 Cr), clad with high purity Al	Synthetic resins; esters; aldehydes; beer and bev.; soaps and cosmetics; essential oils.

Alcoa 43	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 5 Si	Atmosphere; water, short chain aliphatics and their anhydrides; fatty acids, naval stores; soaps.
Alcoa 214	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 3.8 Mg	Foods; alcohols; esters; petrol. prods.; syn. fibers.
Alcoa B214	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 3.8 Mg, 1.8 Si	Atmosphere; water; foods; ammonium nitrate; syn. resins, beer and bev.
Alcoa 356	Aluminum Co. of Amer., Pittsburgh, Pa.	Al; 7 Si; 0.3 Mg	Hydrogen peroxide; short chain aliphatics and their anhydrides; nitric acid; aldehydes; rubber; refrigerants.
Allegheny Metal	Allegheny Ludlum Steel Corp., Brackenridge, Pa.	Various standard stainless steels.	
Aloyco-20	Alloy Steel Products Co., Linden, N. J.	Fe; 19-21 Cr; 28-30 Ni; 4.0-4.5 Cu; 2.5-3.0 Mo; 1.5 max Si; 0.65-0.85 Mn; 0.07 max. C	
Alumel	Hoskins Mfg. Co., Detroit, Mich.	94 Ni; 4 Al; 1 Si; 1 Mn	
Ambraloy 901	Amer. Brass Co., Waterbury, Conn.	95 Cu; 9 Al	
Ambraloy 917	Amer. Brass Co., Waterbury, Conn.	82 Cu; 9½ Al; 5 Ni; 2½ Fe; 1 Mn	
Ambraloy 927	Amer. Brass Co., Waterbury, Conn.		
American Stainless	Amer. Steel Foundries, Newark, N. J.	Various standard stainless steels.	
A Metal	Midvale Co., Philadelphia, Pa.	Fe, 19 Cr; 35 Ni; 0.35 C; 1 Si; 0.5 Mn	
AMF	Midvale Co., Philadelphia, Pa.	Fe; 46-50 Ni; 0.1-0.2 C; 1-2 Mn	
Ampco 8	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 7.5 Al; 2-2.5 Fe	Sulphuric, acetic, citric acids; sodium chloride; alcohols; hydrocarbons.
Ampco 12	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 8.5-9.3 Al; 2.5-3.25 Fe	
Ampco 15	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 9-10 Al; 2.75-3.75 Fe	
Ampco 16	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 9.6-10.3 Al; 3-4 Fe	
Ampco 18	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 10.3-11 Al; 3.0-4.25 Fe	
Ampcoloy 40	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 9.5-10.5 Al; 0.20 max. Fe	
Ampcoloy 45	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 9.7-10.9 Al; 2.0-3.5 Fe; 4.5-5.5 Ni; 1.5 max. Mn	
Ampcoloy 49	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 6.5-9 Al; 4 max. Fe; 2 max. Mn	
Ampcoloy 62	Ampco Metal, Inc., Milwaukee, Wis.	55-60 Cu; 0.5-1.5 Al; 0.4-2.0 Fe; 1.5 max. Mn; 1.0 max. Sn; 0.4 max. Pb; 0.5 max. Ni; bal. Zn	
Ampcoloy 66	Ampco Metal, Inc., Milwaukee, Wis.	60-68 Cu; 3-7 Al; 2-4 Fe; 2.5-5 Mn; 0.5 max. Sn; 0.2 max. Pb; 0.5 max. Ni; bal. Zn;	
Ampcoloy A3	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 9-10 Al; 1.25 max. Fe	
Ampcoloy E123	Ampco Metal, Inc., Milwaukee, Wis.	Cu; 9.5-11 Al; 1.5 max. Fe	
Antaciron	Worthington Pump & Machinery Corp., Harrison, N. J.	Fe; 14.5 Si	Sulphuric acid slurries (under reducing conditions); hydrochloric, sulphuric acids; acid chlorides; stray current conditions.
Armco	Amer. Rolling Mill Co., Middletown, Ohio	Various standard stainless steels.	
Asarco Acid Lead	Amer. Smelting & Ref. Co., New York, N. Y.	Pb; 0.06 Cu; 0.025 Bi; 0.002 Ag; 0.001 Zn; 0.002 Fe	Sulphuric, sulphurous, phosphoric, chromic, hydrofluoric acids.
Beraloy	Wilbur B. Driver Co., Newark, N. J.	Cu; 1.9 Be; 0.5 max. Co; 0.5 max. Ni	
Berylco 25	Beryllium Corp., Reading, Pa.	Cu; 1.9-2.15 Be; 0.05-0.4 Co ; 0.1 max. Fe; 0.15 max. Si	
Brass, Aluminum	Generally available *	76 Cu; 22 Zn; 2 Al	Sea and harbor waters; distillery liquors; petrol. prods.
Brass, Cartridge	Generally available *	70 Cu; 30 Zn	Corrosive atmospheres; salt water; weak alkalis.
Brass, Forging	Scovill Mfg. Co., Waterbury, Conn.	60 Cu; 2 Pb; bal. Zn	Corrosive atmospheres; salt water; weak alkalis.
Brass, Free Cutting	Scovill Mfg. Co., Waterbury, Conn.	61.5 Cu; 3 Pb; bal. Zn	Corrosive atmospheres; salt water; weak alkalis.
Brass, High	Generally available *	66 Cu; 34 Zn	
Brass, Low	Generally available *	80 Cu; 20 Zn	Corrosive atmospheres; hot and cold fresh water; salt water, organic acids; weak alkalis.
Brass, Low Leaded	Scovill Mfg. Co., Waterbury, Conn.	67 Cu; 0.5 Pb; bal. Zn	Corrosive atmospheres; salt water; weak alkalis.
Brass, Med. Leaded	Scovill Mfg. Co., Waterbury, Conn.	64.5 Cu; 1.0 Pb; bal. Zn	Corrosive atmospheres; salt water; weak alkalis.
Brass, Naval	Generally available *	60 Cu; 39.25 Zn; 0.75 Sn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis and mineral acids.
Brass, Naval, Leaded	Scovill Mfg. Co., Waterbury, Conn.	60 Cu; 0.75 Sn; 1.75 Pb; bal. Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis and mineral acids.
Brass, Red	Generally available *	85 Cu; 15 Zn	Acid sludge lines in oil refineries; salt and fresh water; non-oxidizing acids.
Brass, Tin	Scovill Mfg. Co., Waterbury, Conn.	92 Cu; 1 Sn; 7 Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; organic and weak mineral acids.
Bronze, Aluminum	Generally available *	82-95 Cu; 5-10 Al; Fe; Mn; Ni; Sn	Sulphuric, acetic, citric acids; sodium chloride; hydrocarbons; distillery liquors; fresh and salt water.

NOTE: Many of the names listed here in the "Materials" column are trademarks and are not to be understood by presentation here to denote generic or descriptive names for general use.

* "Generally available" copper alloys may be obtained from such companies as the following: American Brass Co., Waterbury, Conn.; American Metal Co., New York, N. Y.; Ampco Metal Inc., Milwaukee, Wis.; Bridgeport Brass Co., Bridgeport, Conn.; Bristol Brass Co., Bristol, Conn.; Chase Brass & Copper Co., Waterbury, Conn.; Mueller Brass Co., Port Huron, Mich.; New England Brass Co., Taunton, Mass.; Phelps Dodge Copper Products Corp., New York, N. Y.; Revere Copper & Brass, Inc., New York, N. Y.; Riverside Metal Co., Riverside, N. J.; Scovill Mfg. Co., Waterbury, Conn.; Seymour Mfg. Co., Seymour, Conn.; Wolverine Tube Co., Detroit, Mich.

Materials	Manufacturer	Description	Most Important Applications
Bronze, Aluminum Silicon	Bridgeport Brass Co., Bridgeport, Conn.	91 Cu; 7 Al; 2 Si	Water; non-oxidizing acids.
Bronze, Commercial	Generally available *	90 Cu; 10 Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; organic and weak mineral acids.
Bronze, Commercial, Leaded	Scovill Mfg. Co., Waterbury, Conn.	89 Cu; 1.75 Pb; 9.25 Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; organic and weak mineral acids.
Bronze, 600 Forgeable Bearing	Mueller Brass Co., Port Huron, Mich.		
Bronze, Gilding 95%	Scovill Mfg. Co., Waterbury, Conn.	95 Cu; 5 Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; organic and weak mineral acids.
Bronze, Hardware	Scovill Mfg. Co., Waterbury, Conn.	89 Cu; 8 Zn; 2 Pb; 1 Ni	
Bronze, High Leaded Tin	Mueller Brass Co., Port Huron, Mich.		
Bronze, Manganese	Mueller Brass Co., Port Huron, Mich.		
Bronze, High Strength Manganese	Mueller Brass Co., Port Huron, Mich.		
Bronze, Phosphor, 5%	Generally available *	95 Cu; 5 Sn; P	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; Fourdrinier wire; organic and weak mineral acids.
Bronze, Silicon, High	Bridgeport Brass Co., Bridgeport, Conn.	97 Cu; 3 Si	Water; non-oxidizing acids; refrigerants; atmosphere.
Bronze, Silicon, Low	Bridgeport Brass Co., Bridgeport, Conn.	98.2 Cu; 1.8 Si	Water; non-oxidizing acids; refrigerants; atmosphere.
Bronze, Spring	Scovill Mfg. Co., Waterbury, Conn.	86.5 Cu; 2 Sn; 11.5 Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; organic and weak mineral acids.
Bronze, Tobin	Generally available *	60 Cu; 39.25 Zn; 0.75 Sn	Salt water; atmosphere.
Buflokast Gray Iron	Buflovak Equipment Div., Blaw-Knox Co.	Fe; 3.2-3.6 C; 2 max. Ni; 1-2 Si; 0.6-0.9 Mn	
CA Stainless	Cooper Alloy Fdry. Co., Hillside, N. J.	Various standard stainless steels.	
Calite A	Calorizing Co., Wilkinsburg, Pa.	Fe; 35 Ni; 15 Cr	
Calite B28	Calorizing Co., Wilkinsburg, Pa.	Fe; 25 Cr; 10 Ni; 1 Mo	
Carpenter Stainless	Carpenter Steel Co., Reading, Pa.	Various standard stainless steels.	
Carpenter Stainless 20	Carpenter Steel Co., Reading, Pa.	Fe; 29 Ni; 20 Cr; 3 Cu; 2 Mo; 0.07 max. C.	Sulphuric, mixed, phosphoric, oxalic, fatty acids.
Causul Metal	Lunkenheimer Co., Cincinnati, Ohio	Fe; 19 Ni, 2.2-2.8 C; 4 Cu; 1.5 Cr	Sulphuric acid; sodium hydroxide; brine; paper liquors (sulphate and soda processes).
Chemalloy Stainless	Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Various standard stainless steels.	
Chemalloy A52N	Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Fe; 21 Cr; 27 Ni; 2 Mo; 3 Cu; 2 Si	Non-oxidizing media.
Chemalloy H1	Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Ni; 21 Mo; 21 Fe	Halogen ion services.
Chemalloy H2	Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Ni; 29 Mo; 6 Fe	Hydrochloric, phosphoric, sulphuric acids.
Chemalloy H3	Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Ni; 14 Cr; 16 Mo; 4 W; 6 Fe	Strong oxidizing agents; sulphurous, acetic, formic acids.
Chemalloy H4	Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Ni; 10 Si; 3 Cu	Sulphuric acid.
Chlorimet 2	Duriron Co., Dayton, Ohio	63 Ni; 32 Mo; 3 Fe; 0.10 C; 1 Si	Hydrochloric, sulphuric, phosphoric acids, non-oxidizing chlorides.
Chlorimet 3	Duriron Co., Dayton, Ohio	60 Ni; 18 Mo; 18 Cr; 3 Fe; 0.07 max. C; 1 Si	Hydrochloric, sulphuric, phosphoric chloroacetic acids; moist chlorine.
Chromax	Driver Harris Co., Harrison, N. J.	Fe; 19 Cr; 35 Ni	Cyanide pots, neutral and alkaline salts, mild hydrochloric, sulphuric, organic acids.
Chromel A	Hoskins Mfg. Co., Detroit, Mich.	80 Ni; 20 Cr	
Chromel C and D	Hoskins Mfg. Co., Detroit, Mich.	35-61 Ni; 16-18½ Cr; 23-46½ Fe	
Chromel P	Hoskins Mfg. Co., Detroit, Mich.	90 Ni; 10 Cr	
Circle L Stainless	Lebanon Steel Fdry., Lebanon, Pa.	Various standard stainless steels.	
Colonial 610	Vanadium Alloys Steel Co., Latrobe, Pa.	Fe; 16-18 Cr; 1 Ni; 0.12 max. C; S (optional)	
Cooper Stainless	Cooper Alloy Foundry Co., Hillside, N. J.	Various standard stainless steels	
Cooper FA20	Cooper Alloy Foundry Co., Hillside, N. J.	28-30 Ni; 19-21 Cr; 3.5 Mo; 4-4.5 Cu; 1.5 max. Si; 0.07 max. C	Sulphuric, hydrochloric, phosphoric acids, oxidizing chloride salts.
Copel	Hoskins Mfg. Co., Detroit, Mich.	55 Cu; 45 Ni	
Copper	Generally available *	99.9 + Cu	Fresh and salt water, refrigerants (except ammonia); paper mill stock and white water; soil; brewery and distillery products.
Copper, Beryllium	Generally available *	97.5 Cu; 2.15 Be; 0.35 Ni	
Copper Cadmium	Phelps Dodge Copper Prod. Corp., New York, N. Y.	99 Cu; 1 Cd	

Copper, Deoxidized	Generally available *	99.9 + Cu; 0.01-0.03 P	Water; distillery, brewery and paper mill liquors; steam; refrigerants; gasoline, oil; salts, acetic acid.
Copper, Phosphorized	Mueller Brass Co., Port Huron, Mich.	99.9 Cu; trace P	
Copper, Tellurium	Chase Brass & Copper Co., Waterbury, Conn.	99.5 Cu; 0.5 Te	
Corrosiron	Pacific Fdry. Co. Ltd., San Francisco, Calif.	Fe; 14.5 Si	Nitric, sulphuric, chromic, hydrochloric acids; mine water; ferrous and copper sulphate.
Croloy Intermediate	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; 5, 7 or 9 Cr; 0.5 or 1 Mo	Petrol. ref. (sulphur compounds).
Croloy Stainless	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Various standard stainless steels.	
Croloy Clad Plate	Babcock & Wilcox Co., New York, N. Y.	Steel clad with various standard stainless steels.	
Cupaloy	Westinghouse Electric Corp., Pittsburgh, Pa.	99.4 Cu; 0.1 Ag; 0.5 Cr.	Oxidation resistance at high temperatures.
Cupron	Wilbur B. Driver Co., Newark, N. J.	Cu; 45 Ni	
Cupro-Nickel, 15,20,30%	Generally available *	Cu; 15, 20 or 30 Ni	Sea and harbor waters; salt brines; non-oxidizing acids; petrol. prods., caustics.
Disston Stainless	Henry Disston & Sons Inc., Philadelphia, Pa.	Various standard stainless steels.	
Dopploy 30	Sowers Mfg. Co., Buffalo, N. Y.	Fe; 18.5 Ni; 2.35 Cr; 2.85 C; 1 Mn	
Dowmetal	Dow Chemical Co., Midland, Mich.	Various magnesium alloys.	
Duraloy Stainless	Duraloy Co., Scottdale, Pa.	Various standard stainless steels.	
Durco Stainless	Duriron Co., Dayton, Ohio	Various standard stainless steels.	
Durco D-10	Duriron Co., Dayton, Ohio	56 Ni; 23 Cr; 8 Cu; 4 Mo; 2 W; 1 Mn	Sulphuric, phosphoric acids.
Durichlor	Duriron Co., Dayton, Ohio	Fe; 0.85 C; 14.5 Si; 3 Mo; 0.65 Mn	Hydrochloric acid; hypochlorite bleaches; chloride solutions; moist chlorine.
Durimet 20	Duriron Co., Dayton, Ohio	Fe; 20 Cr; 29 Ni; 0.07 max. C; 2 Mo; 4 Cu; 1 Si	Sulphuric, nitric, acetic, sulphurous acids; fatty acids; plating solutions.
Duriron	Duriron Co., Dayton, Ohio	Fe; 0.85 C; 14.5 Si; 0.65 Mn	Sulphuric, nitric, acetic acids; alum solutions; plating solutions.
Eastern Stainless	Eastern Stainless Steel Corp., Baltimore, Md.	Various standard stainless steels.	
Enduro Stainless	Republic Steel Corp., Cleveland, Ohio	Various standard stainless steels.	
Everdur 1000	Amer. Brass Co., Waterbury, Conn.	94.9 Cu; 4 Si; 1.1 Mn	
Everdur 1010	Amer. Brass Co., Waterbury, Conn.	95.8 Cu; 3.1 Si; 1.1 Mn	
Everdur 1015	Amer. Brass Co., Waterbury, Conn.	98.25 Cu; 1.5 Si; 0.25 Mn	
Fahrite Stainless	Ohio Steel Fdry. Co., Lima; Ohio	Various standard stainless steels.	
Fanweld	Fansteel Metallurgical Corp., North Chicago, Ill.	Hard facing rod; W, Cr, Co, TaC, CbC	Nitric, sulphuric, acetic, lactic acids; salt water brine; hydrogen sulphide.
Frontier 5	Frontier Bronze Corp., Niagara Falls, N. Y.	89 Cu; 10 Al; 1 Fe	
Frontier 11	Frontier Bronze Corp., Niagara Falls, N. Y.	88 Cu; 5 Ni; 5 Sn; 2 Zn	
Frontier 40	Frontier Bronze Corp., Niagara Falls, N. Y.	Cu; 5 Zn; 0.5 Mg; 0.5 Cr; 0.2 Ti	
Gold	Baker & Co. Inc., Newark, N. J.	99.99 Au	Nitric, hydrochloric, sulphuric, hydrofluoric acids.
Gun Metal	Mueller Brass Co., Port Huron, Mich.		
Hastelloy A	Haynes Stellite Co., Kokomo, Ind.	Ni; 20-22 Mo; 18-20 Fe	Hydrochloric, sulphuric, acetic, formic acids; all alkalis.
Hastelloy B	Haynes Stellite Co., Kokomo, Ind.	Ni; 26-30 Mo; 4-7 Fe;	Hydrochloric, sulphuric, phosphoric, nitric, acetic, formic acids.
Hastelloy C	Haynes Stellite Co., Kokomo, Ind.	Ni; 16-18 Mo; 4-7 Fe; 14-16 Cr, 3.75-5 W	Strong oxidizing agents; free chlorine; phosphoric, nitric, sulphuric acids.
Hastelloy D	Haynes Stellite Co., Kokomo, Ind.	Ni; 8-11 Si; 3-5 Cu	Sulphuric, acetic, formic, phosphoric acids.
Haynes Stellite 1	Haynes Stellite Co., Kokomo, Ind.	Co; 30-32 Cr; 12-14 W	Chlorine; sulphuric, nitric acids.
Haynes Stellite 6	Haynes Stellite Co., Kokomo, Ind.	Co; 27-29 Cr; 3.75-4.5 W	Sulphuric, nitric acids.
Haynes Stellite 12	Haynes Stellite Co., Kokomo, Ind.	Co; 28-30 Cr; 7.5-9 W	Sulphuric, nitric acids.
Haynes Stellite 98M2	Haynes Stellite Co., Kokomo, Ind.	Co; 30-31 Cr; 18.55-18.95 W; 3.5-3.75 Ni	Sulphuric acid.
Haynes Stellite Star J	Haynes Stellite Co., Kokomo, Ind.	Co; 32-32.75 Cr; 17.25-17.75 W	Sulphuric acid.
Herculoy	Revere Copper and Brass, New York, N. Y.	96-98 Cu; 1.5-3 Si; 0.25-1 Mn	Atmosphere; fresh and salt water; brewery and distillery products.
Hytensl	Amer. Manganese Bronze Co., Philadelphia, Pa.	60-68 Cu; 20-24 Zn; 3-7 Al; 2.5-5 Mn; 2-4 Fe	
Illium G	Burgess-Parr Co., Freeport, Ill.	56 Ni; 22.5 Cr; 6.5 Mo; 6.5 Fe; 6.5 Cu; Mn; Si; C	Sulphuric, nitric, phosphoric, mixed acids; various acid-salt solutions.
Inconel	International Nickel Co., New York, N. Y.	76 Ni; 15.5 Cr; 7.5 Fe; 0.08 C	Organic acids; pharmaceuticals; alcoholic beverages; food; alkali fusion.
Inconel-Clad Steel	Lukens Steel Co., Coatsville, Pa.		Carbonic, lactic, picric acids; cola sirup; penicillin; wine.
Indium Metal	Amer. Smelting and Ref. Co., New York, N. Y.	In	
Ingersoll Stainless	Ingersoll Steel Div., Borg-Warner Corp., Chicago, Ill.	Various standard stainless steels.	
Isocast 20	Empire Steel Castings, Inc., Reading, Pa.	Fe; 20 Cr; 29 Ni; 0.07 max. C; 3.5 min. Cu; 1.75 Mo; 1 min. Si	
Isocast Stainless	Empire Steel Castings, Inc., Reading, Pa.	Various standard stainless steels.	
Jessop Stainless and Stainless-Clad	Jessop Steel Co., Washington, Pa.	Various standard stainless steels.	
K42B	Westinghouse Electric Corp., Pittsburgh, Pa.	42 Ni, 22 Co, 18 Cr, 14 Fe; 2.2 Ti	Oxidation resistance at high temperatures.
Kanthal Alloys	C. O. Jelliff Mfg. Corp., Southport, Conn.	Fe; 20-25 Cr; Co; Al	
Lead	Eagle-Picher Co., Cincinnati, Ohio	99.9+ Pb	
Lead, Antimonial	Amer. Smelting & Ref. Co., New York, N. Y.	94 Pb, 6 Sb	Sulphuric, sulphurous, phosphoric, chromic acids.

Materials	Manufacturer	Description	Most Important Applications
Lead, Antimonial	Eagle-Picher Co., Cincinnati, Ohio		Sulphuric, mixed acids; chlorine gas; para-nitrophenol; sodium and zinc chlorides.
Lead, Antimonial	National Lead Co., New York, N. Y.	Pb; 6 Sb	Sulphurous, sulphuric, phosphoric, chromic acids; hydroxides; chlorides.
Lead, Antimonial	Northwest Lead Co., Seattle, Wash.	93.45 Pb; 6.5 Sb; 0.04-0.08 Cu	Sulphuric, phosphoric acids; aluminum sulphate; sodium sulphate; ammonium sulphate; mixed acids.
Lead, Chemical	Eagle-Picher Co., Cincinnati, Ohio		Sulphuric, mixed acids; chlorine gas; para-nitrophenol; sodium and zinc chlorides.
Lead, Chemical	National Lead Co., New York, N. Y.	99.93 Pb; 0.06 Cu; 0.01 Ag; 0.005 Bi	Sulphurous, sulphuric, phosphoric, chromic acids; hydroxides; chlorides
Lead, Chemical	Northwest Lead Co., Seattle, Wash.	99.95 Pb; 0.04-0.08 Cu	Sulphuric, phosphoric acids; aluminum sulphate; sodium sulphate; ammonium sulphate; mixed acids.
Lead, Tellurium	Northwest Lead Co., Seattle, Wash.	99.9 Pb; 0.02-0.06 Te; 0.04-0.08 Cu	Sulphuric, phosphoric acids; aluminum sulphate; sodium sulphate; ammonium sulphate; mixed acids.
Lead, Tellurium	Eagle-Picher Co., Cincinnati, Ohio		Sulphuric, mixed acids; chlorine gas; para-nitrophenol; sodium and zinc chlorides.
Lead, Tellurium	National Lead Co., New York, N. Y.	99.88 Pb; 0.04 Te; 0.06 Cu	Sulphurous, sulphuric, phosphoric, chromic acids; hydroxides; chlorides.
Lukens Clad Steel	Lukens Steel Co., Coatesville, Pa.	Steel clad with Inconel, Monel, nickel or stainless	
Michiana Stainless	Michiana Products Corp., Michigan City, Ind.	Various standard stainless steels.	
Midvaloy Stainless	Midvale Co., Philadelphia, Pa.	Various standard stainless steels.	
Milwaukee Stainless	Milwaukee Steel Fdry.; Milwaukee, Wis.	Various standard stainless steels.	
Misco Stainless	Michigan Steel Casting Co.; Detroit, Mich.	Various standard stainless steels.	
Misco 20	Michigan Steel Casting Co.; Detroit, Mich.	Fe; 30 Ni; 20 Cr; 2.5 Mo; 4 Cu	
Miscrome Stainless	Michigan Steel Casting Co., Detroit, Mich.	Various standard stainless steels.	
Monel	International Nickel Co.; New York, N. Y.	67 Ni; 30 Cu; 1.4 Fe; 0.15 C	Non-oxidizing mineral acids; fixed alkalis; brines and sea water; fatty acids; organic solvents.
Monel-Clad	Lukens Steel Co., Coatesville, Pa.		Acetic, hydrofluoric, oxalic acids; alcohol; butadiene; carbon dioxide.
Mueller 85-5-5-5	Mueller Brass Co., Port Huron, Mich.		
Muntz Metal	Generally available *	60 Cu; 40 Zn	
N-3 Metal	Lukenheimer Co., Cincinnati, Ohio	Cu; 32 Ni; 2.75 Pb; 9.5 Si; 0.75 Mn	Sludge acid; sulphuric; sea water; alum; salt solutions; garbage liquor.
National Al Alloys	National Smelting Co., Cleveland, Ohio	Al; 0-4 Cu; 0-4 Mg; 0-7.5 Si; 0-0.6 Mn; 0-1.5 Ni	
Niag	Mueller Brass Co., Port Huron, Mich.		
Nichrome	Driver Harris Co., Harrison, N. J.	60 Ni; 15 Cr; Fe	Cyanide pots; neutral and alkaline salts; mild hydrochloric, sulphuric, organic acids.
Nichrome V	Driver Harris Co., Newark, N. J.	80 Ni; 20 Cr	Neutral and alkaline salts; mild hydrochloric, sulphuric, organic acids.
Nickel	International Nickel Co., New York, N. Y.	99.4 Ni; 0.05 C	Fixed alkalis; hydrochloric acid; food; phenol; organic solvents; rayon spin solutions.
Nickel L	International Nickel Co., New York, N. Y.	99.4 Ni; 0.01 C	Fused alkalis.
Nickel-Clad	Lukens Steel Co., Coatesville, Pa.		Caustic soda; fatty acids; naphtha; crude phenol; petroleum; pulp and paper; soap.
Nickel Silver, 5,10,18%	Generally available *	65 Cu; 5, 10 or 18 Ni; bal. Zn	Corrosive atmospheres; hot and cold fresh water; salt water; weak alkalis; organic and weak mineral acids.
Nicloy	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; 3.5, 5 or 9 Ni	Alkaline solutions; mild organic acids.
Ni-Hard	International Nickel Co., New York, N. Y.	Fe; 3.4 C; 1.5 Cr; 4.5 Ni; 0.6 Si	
Nilstain	Wilbur B. Driver Co., Newark, N. J.	Fe; 18-20 Cr; 8-10 Ni; 0.2 max. C; 2 max. Mn	
Ni-Resist	International Nickel Co., New York, N. Y.	Fe; 2.8 C; 14 or 20 Ni; 6 Cu (optional); 2 Cr; 2 Si	
Nirex	Driver-Harris Co., Harrison, N. J.	80 Ni; 14 Cr; 6 Fe	Neutral and alkaline salts; mild hydrochloric, sulphuric, organic acids.
NS-5 Metal	Lunkenheimer Co., Cincinnati, Ohio	50 Ni; 46 Cu; 2.2 Si; 1.9 Mn	Corrosion resistance similar to Monel.
Olympic Bronze, Type A	Chase Brass & Copper Co., Waterbury, Conn.	96 Cu; 3 Si; 1 Zn	Pickling acids and salt brines.
Palladium	Baker & Co., Newark, N. J.	99.99 Pd	Hydrochloric, sulphuric, hydrofluoric acids.
Pennalloy	Pennsylvania Elec. Steel Casting Co., Hamburg, Pa.		
Permite Al Alloys	Aluminum Industries, Cincinnati, Ohio	Al; 0-5 Cu; 1.5-7.5 Si; 0-1 Fe; 0-0.4 Mg	
Pioneer	Pioneer Alloy Products Co., Cleveland, Ohio	65 Ni; Cr; Mo; Fe	
Platinum	Baker & Co., Newark, N. J.	99.99 Pt	Nitric, hydrochloric, sulphuric, hydrofluoric acids; chlorine; bromine.
Platinum	J. Bishop & Co., Malvern, Pa.	99.95 Pt	
Platinum, Iridio	Baker & Co., Newark, N. J.	Pt; 5-30 Ir	Nitric, hydrochloric, sulphuric, hydrofluoric acids; chlorine; bromine.
Platinum, Iridium	J. Bishop & Co., Malvern, Pa.	Pt; 10-30 Ir	
Platinum, Rhodio	Baker & Co., Newark, N. J.	Pt; 5-40 Rh	Nitric, hydrochloric, sulphuric, hydrofluoric acids; chlorine, bromine.
Pyrasteel	Chicago Steel Fdry. Co., Chicago, Ill.	Fe; 25-27 Cr; 12-14 Ni; 0.1-0.35 C; Mo, Cb, Se (optional)	
Pyrocast	Pacific Fdry. Co. Ltd., San Francisco, Calif.	Fe; 25 Cr	Hot sulphur dioxide atmospheres; cyanide pots; mercuric nitrate.

Pyrocast	Pacific Fdry. Co. Ltd., San Francisco, Calif.	Fe; 25 Cr	Hot sulphur dioxide atmospheres; cyanide pots; mercuric nitrate.
Pyrocast Stainless	Pacific Fdry. Co. Ltd., San Francisco, Calif.	Various standard stainless steels.	
Refractaloy 26	Westinghouse Electric Corp., Pittsburgh, Pa.	37 Ni; 20 Co; 18 Cr; 3 Mo; 2.8 Ti; 18 Fe	Oxidation resistance at high temperatures.
Refractaloy-70	Westinghouse Electric Corp., Pittsburgh, Pa.	20 Ni; 30 Co; 20 Cr; 15 Fe; 8 Mo; 4 W; 2 Mn	Oxidation resistance at high temperatures.
Resistac	Amer. Manganese Bronze Co., Philadelphia, Pa.	90 Cu; 10 Al	Sulphuric acid; salt solutions and vapors.
Revalon	Revere Copper and Brass, New York, N. Y.	76 Cu; 22 Zn; 2 Al	Salt and fresh water.
Rex Z-Metal	Chain Belt Co., Milwaukee, Wis.	Iron carbide particles in ferrite matrix.	Sugar cane solution; salt and mine water; sulphuric, tannic and lactic acids.
Reynolds 2S	Reynolds Metals Co., Louisville, Ky.	99 Al; 1 max. Fe + Si; 0.2 max. Cu	
Reynolds 3S	Reynolds Metals Co., Louisville, Ky.	Al; 1-1.5 Mn; 0.7 max. Fe; 0.6 max. Si; 0.2 Cu	
Reynolds 14S	Reynolds Metals Co., Louisville, Ky.	Al; 3.9-5 Cu; 0.5-1.2 Si; 1 max. Fe; 0.4-1.2 Mn; 0.2-0.8 Mg	
Reynolds 17S	Reynolds Metals Co., Louisville, Ky.	Al; 3.5-4.5 Cu; 0.8 max. Si; 1 max Fe; 0.4-1 Mn; 0.2-0.8 Mg	
Reynolds 18S	Reynolds Metals Co., Louisville, Ky.	Al; 3.5-4.5 Cu; 1.7-2.3 Ni; 0.9 max. Si; 1 max. Fe; 0.45-0.9 Mg	
Reynolds 24S	Reynolds Metals Co., Louisville, Ky.	Al; 3.8-4.9 Cu; 1.2-1.8 Mg; 0.5 max. Si	
Reynolds 24S Pureclad	Reynolds Metals Co., Louisville, Ky.	Al 24S core covered with Al of high purity.	
Reynolds 2^{4}S	Reynolds Metals Co., Louisville, Ky.	Al; 3.9-5 Cu; 0.5-1.2 Si; 1 max. Fe	
Reynolds 32S	Reynolds Metals Co., Louisville, Ky.	Al; 11-13.5 Si; 0.5-1.3 Cu; 1.0 max. Fe; 0.8-1.3 Mg; 0.5-1.3 Ni	
Reynolds A51S	Reynolds Metals Co., Louisville, Ky	Al; 0.6-1.2 Si; 1 max. Fe; 0.35 Cu; 0.45-0.8 Mg	
Reynolds 52S	Reynolds Metals Co., Louisville, Ky.	Al; 2.2-2.8 Mg; 0.45 max. Fe plus Si; 0.1 max. Cu	
Reynolds 53S	Reynolds Metals Co., Louisville, Ky.	Al; 0.35 max. Fe; 1.1-1.4 Mg; 0.15-0.35 Cr	
Reynolds 61S	Reynolds Metals Co., Louisville, Ky.	Al; 0.4-0.8 Si; 0.7 max. Fe; 0.8-1.2 Mg	
Reynolds R301	Reynolds Metals Co., Louisville, Ky.	High strength Al alloy core clad with corrosion resistant Al alloy of intermediate strength.	
Rezistal Stainless	Crucible Steel Co. of Amer., New York, N. Y	Various standard stainless steels.	
Roofloy	Amer. Smelting & Ref. Co., New York, N. Y.	Pb; 0.25 Sn; 0.02 Mg; 0.02 Bi	
St. Joe Lead	St. Joseph Lead Co., New York, N. Y.	99.90 plus Pb; 0.04-0.08 Cu; 0.002-0.02 Ag; 0.002 max. Fe; 0.001 max. Zn; 0.002 max. As, Sb, Sn	
Silver	Baker & Co. Inc., Newark, N. J.	99.9 plus Ag	Sulphuric, hydrofluoric, acetic acids.
Silver	Handy & Harman, New York, N. Y.	99.9 plus Ag	
Stainless - Clad 304	Lukens Steel Co., Coatesville, Pa.		
Stainless - Clad 316	Lukens Steel Co., Coatesville, Pa.		
Stainless - Clad 347	Lukens Steel Co., Coatesville, Pa.		
Stainless - Clad 410	Lukens Steel Co., Coatesville, Pa.		
Stainless - Clad 430	Lukens Steel Co., Coatesville, Pa.		
Stainless Type 301		Fe; 16-18 Cr; 6-8 Ni; 0.08-0.15 C	Automotive and decorative trim; high tensile cold rolled strip.
Stainless Type 302		Fe; 17-19 Cr; 8-10 Ni; 0.08-0.15 C	Milk; carbonated water; fruit juices; room temp. basic salts; atmosphere.
Stainless Type 302B		Fe; 17-19 Cr; 8-10 Ni; 0.08-0.15 C; 2-3 Si	
Stainless Type 303		Fe; 17-19 Cr; 8-10 Ni; 0.15 max. C; 0.07 min. P, S, Se; 0.6 max. Zr, Mo; 2 max. Mn	Free machining; slightly less corrosion resistant than 302.
Stainless Type 304		Fe; 18-20 Cr; 8-11 Ni; 0.08 max. C; 2 max. Mn	Basic salts; nitric, acetic, fatty acids; sour crudes.
Stainless Type 308		Fe; 19-21 Cr; 10-12 Ni; 0.08 max. C	Sulphite liquors; basic salts; nitrates; nitric, acetic acid.
Stainless Type 309		Fe; 22-24 Cr; 12-15 Ni; 0.2 max. C	Hot oxidizing gases; nitric acid; sour crudes.
Stainless Type 310		Fe; 24-26 Cr; 19-22 Ni; 0.25 max. C	Hot oxidizing gases; sulphur dioxide; nitric, fatty, acetic acids; sour crudes.
Stainless Type 316		Fe; 16-18 Cr; 10-14 Ni; 0.1 max. C; 1.75-2.75 Mo	Hot acetic and fatty acids; sulphite liquor; sulphur dioxide; phosphoric acid; phthalic anhydride; photo emulsions.
Stainless Type 317		Fe; 17.5-20 Cr; 10-14 Ni; 0.1 max. C; 3-4 Mo	Slightly better than 316 because of higher Mo.
Stainless Type 321		Fe; 17-19 Cr; 8-11 Ni; Ti, 5x C min.	High temperature applications.
Stainless Type 347		Fe; 17-19 Cr; 9-12 Ni; Cb, 10x C min.	Same as 304 but for stress relieving or welding of heavy sections.
Stainless Type 403		Fe; 11.5-13 Cr; 0.15 max. C; (turbine quality)	Steam turbine blades.
Stainless Type 405		Fe; 11.5-13.5 Cr; 0.08 max. C; 0.1-0.3 Al	Same as 410 but does not harden appreciably on cooling.
Stainless Type 406		Fe; 12-14 Cr; 0.15 max. C; 3.5-4.5 Al	
Stainless Type 410		Fe; 11.5-13.5 Cr; 0.15 max. C	Hardened valve and pump parts; ammonia; mild fatty, nitric, carbonic acids;
Stainless Type 414		Fe; 11.5-13.5 Cr; 1.25-2.5 Ni; 0.15 max. C	Same as 410 but more responsive to heat treatment.
Stainless Type 416		Fe; 12-14 Cr; 0.15 max. C; 0.07 min. P, S, Se; 0.6 max. Zr, Mo	Free machining; slightly less resistant than 410.
Stainless Type 418		Fe; 12-14 Cr; 0.15 max. C; 2.5-3.5 W	Intermediate high temperature service.
Stainless Type 420		Fe; 12-14 Cr; 0.15 min. C	Cutlery and dental tools.
Stainless Type 430		Fe; 14-18 Cr; 0.12 max. C	Automotive and decorative trim; nitric acid; hot oxidizing gases.
Stainless Type 430F		Fe; 14-18 Cr; 0.12 max. C; 0.07 min. P, S, Se; 0.6 max. Zr, Mo	Free machining; slightly less resistant than 430

NOTE: Listed below are the producers of standard stainless steels for which type analyses have been established by the Amer. Iron and Steel Inst.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Metal Wire Co., Prospect Park, Pa.
Amer. Chain & Cable Co., Bridgeport, Conn.
Amer. Rolling Mill Co., Middletown, Ohio
Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
A. M. Byers Co., Pittsburgh, Pa.
Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Cooper Alloy Fdry. Co., Elizabeth, N. J.
Copperweld Steel Co., Warren, Ohio
Crucible Steel Co. of America, New York, N. Y.
Wilbur B. Driver Co., Newark, N. J.
Eastern Stainless Steel Corp., Baltimore, Md.
Firth Sterling Steel Co., McKeesport, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
Henry Disston & Sons, Philadelphia, Pa.
Ingersoll Steel Div., Borg-Warner Corp., New Castle, Ind.
Jessop Steel Co., Washington, Pa.
Joslyn Mfg. & Supply Co., Chicago, Ill.

Materials	Manufacturer	Description	Most Important Applications
Stainless Type 431	Latrobe Electric Steel Co., Latrobe, Pa.	Fe; 15-17 Cr; 1.25-2.5 Ni; 0.2 max. C	Hardenable; resistance approaches 302; paper mill beater bars, Jordan bars.
Stainless Type 440A	McLouth Steel Corp., Detroit, Mich.	Fe; 16-18 Cr; 0.6-0.75 C; 0.75 max. Mo	About same as 410.
Stainless Type 440B	Michiana Products Corp., Michigan City, Ind.	Fe; 16-18 Cr; 0.75-0.95 C; 0.75 max. Mo	About same as 410.
Stainless Type 440C	Midvale Co., Philadelphia, Pa.	Fe; 16-18 Cr; 0.95-1.2 C; 0.75 max. Mo	About same as 410
Stainless Type 442	Pittsburgh Steel Co., Pittsburgh, Pa.	Fe; 18-23 Cr; 0.25 max. C	High temperatures; nitric, fatty, citric acids; plastic molds; acetic anhydride.
Stainless Type 443	Timken Roller Bearing Co., Canton, Ohio	Fe; 18-23 Cr; 0.2 max. C; 0.9-1.25 Cu	
Stainless Type 446	Republic Steel Corp., Cleveland, Ohio	Fe; 23-27 Cr; 0.35 max. C; 0.25 max. N	High temperatures; nitric, citric, lactic acids; acetic anhydride; ammonium phosphate.
Stainless Type 501	Rotary Electric Steel Corp., Detroit, Mich.	Fe; 4-6 Cr; 0.1 min. C	High temperature oxidation resistance (petrol. refining).
Stainless Type 502	Sharon Steel Corp., Sharon, Pa.	Fe; 4-6 Cr; 0.1 max. C	Same as 501
Stainless Type CA-15	Stanley Works, New Britain, Conn.	Fe; 11-14 Cr; 1 max. Ni; 0.15 max. C	Alkaline liquors.
Stainless Type CA-40	Summerill Tubing Co., Bridgeport, Pa.	Fe; 11-14 Cr; 1 max. Ni; 0.2-0.4 C	Alkaline liquors.
Stainless Type CB-30	Superior Steel Corp., Carnegie, Pa.	Fe; 18-22 Cr; 2 max. Ni; 0.3 max. C	Alcohol; vinegar; fruit juices; oxidizing acids
Stainless Type CC-35	Trent Tube Mfg. Co., East Troy, Wis.	Fe; 26-30 Cr; 4 max. Ni; 0.35 max. C	
Stainless Type CC-50	Universal Cyclops Steel Corp., Bridgeville, Pa.	Fe; 26-30 Cr; 4 max. Ni; 0.5 max. C	
Stainless Type CD-10M	Vanadium Alloys Steel Co., Latrobe, Pa.	Fe; 27-30 Cr; 3-6 Ni; 0.1 max. C; 2 max. Mo	Sulphurous atmospheres; acid mine water; oxidizing acids; organic acids; sulphite liquor.
Stainless Type CE-30	Wallingford Steel Co., Wallingford, Conn.	Fe; 26-30 Cr; 8-11 Ni; 0.3 max. C	Sulphuric liquors.
Stainless Type CF-7		Fe; 18-20 Cr; 8-10 Ni; 0.07 max. C	
Stainless Type CF-10		Fe; 18-20 Cr; 8-10 Ni; 0.1 max. C	Oxidizing mineral acids; organic acids; salts.
Stainless Type CF-16		Fe; 18-20 Cr; 8-10 Ni; 0.16 max. C	
Stainless Type CF-20		Fe; 18-20 Cr; 8-10 Ni; 0.2 max. C	Sodium hydroxide; alum; mine waters; sulphur dioxide; citric, lactic, acetic acids; brine.
Stainless Type CF-7Se		Fe; 18-20 Cr; 8-10 Ni; 0.07 max. C; 0.2-0.35 Se	
Stainless Type CF-7C		Fe; 18-20 Cr; 8-10 Ni; 0.07 max. C; 8xC-1 Cb	
Stainless Type CF-7M		Fe; 18-20 Cr; 8-10 Ni; 0.07 max. C; 1.5-3.5 Mo	
Stainless Type CF-10M		Fe; 18-20 Cr; 8-10 Ni; 0.1 max. C; 1.5-3.5 Mo	Same as CF-10 but better resistance to pitting.
Stainless Type CF-16M		Fe; 18-20 Cr; 8-10 Ni; 0.16 max. C; 1.5-3.5 Mo	
Stainless Type CF-7MC		Fe; 18-20 Cr; 8-10 Ni; 0.07 max. C; 1.5-3.5 Mo; 8xC-1 Cb	
Stainless Type CG-7		Fe; 20-22 Cr; 10-12 Ni; 0.07 max. C	
Stainless Type CG-10		Fe; 20-22 Cr; 10-12 Ni; 0.1 max. C	Similar but more severe service than CF-10.
Stainless Type CG-16		Fe; 20-22 Cr; 10-12 Ni; 0.16 max. C	
Stainless Type CG-16 Se		Fe; 20-22 Cr; 10-12 Ni; 0.16 max. C; 0.2-0.35 Se	
Stainless Type CG-7C		Fe; 20-22 Cr; 10-12 Ni; 0.07 max. C; 8xC-1 Cb	
Stainless Type CG-7M		Fe; 20-22 Cr; 10-12 Ni; 0.07 max. C; 1.5-3.5 Mo	
Stainless Type CG-10M		Fe; 20-22 Cr; 10-12 Ni; 0.1 max. C; 1.5-3.5 Mo	Similar but more severe service than CF-10.
Stainless Type CG-16M		Fe; 20-22 Cr; 10-12 Ni; 0.16 max. C; 1.5-3.5 Mo	
Stainless Type CG-7MC		Fe; 20-22 Cr; 10-12 Ni; 0.07 max. C; 1.5-3.5 Mo; 8xC-1 Cb	
Stainless Type CH-10		Fe; 22-26 Cr; 12-15 Ni; 0.1 max. C	Severer service than CF-10 or CG-10.
Stainless Type CH-20		Fe; 22-26 Cr; 12-15 Ni; 0.2 max. C	Sulphides
Stainless Type CH-10C		Fe; 22-26 Cr; 12-15 Ni; 0.1 max. C; 8xC-1 Cb	
Stainless Type CH-10M		Fe; 22-26 Cr; 12-15 Ni; 0.1 max. C; 1.5-3.5 Mo	Severer service than CF-10 or CG-10.
Stainless Type CH-20M		Fe; 22-26 Cr; 12-15 Ni; 0.2 max. C; 1.5-3.5 Mo	
Stainless Type CH-10MC		Fe; 22-26 Cr; 12-15 Ni; 0.1 max. C; 1.5-3.5 Mo; 8xC-1 Cb	
Stainless Type CK-25		Fe; 23-27 Cr; 19-22 Ni; 0.25 max. C	Marine service; not for reducing acids.
Stainless Type CM-25		Fe; 8-11 Cr; 19-22 Ni; 0.25 max. C	
Stainless Type CN-7		Fe; 18-22 Cr; 20-30 Ni; 0.07 max. C; may contain others.	
Stainless Type CN-25		Fe; 18-22 Cr; 20-30 Ni; 0.25 max. C; may contain others.	Reducing acids.
Stainless Type CS-25		Fe; 8-12 Cr; 29-32 Ni; 0.25 max. C	
Stainless Type CT-7		Fe; 13-17 Cr; 34-37 Ni; 0.07 max. C; may contain others.	
Stainless Type CT-25		Fe; 13-17 Cr; 34-37 Ni; 0.25 max. C; may contain others.	Reducing acids; mixed acids and salts.
Stainless Type HB		Fe; 18-22 Cr; 2 max. Ni	
Stainless Type HC		Fe; 26-30 Cr; 4 max. Ni	Hot gases.
Stainless Type HD		Fe; 26-30 Cr; 3-6 Ni	
Stainless Type HE		Fe; 26-30 Cr; 8-11 Ni	
Stainless Type HF		Fe; 18-23 Cr; 8-11 Ni	High temperatures.
Stainless Type HH		Fe; 23-27 Cr; 11-14 Ni	Hot gases
Stainless Type HI		Fe; 26-30 Cr; 14-17 Ni	
Stainless Type HK		Fe; 23-27 Cr; 19-22 Ni	
Stainless Type HL		Fe; 26-32 Cr; 18-22 Ni	

NOTE: Listed below are the producers of standard cast stainless steel for which type analyses have been established by the Alloy Casting Institute.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Amer. Cast Iron Pipe Co., Birmingham, Ala.
American Manganese Steel Div., American Brake Shoe & Fdry. Co., Chicago Heights
American Steel Castings Co., Newark, N. J.
Atlas Fdry. Co., Irvington, N. J.
Babcock & Wilcox Co., Barberton, Ohio
Calorizing Co., Wilkinsburg, Pa.
Chicago Steel Fdry., Chicago, Ill.
Cooper Alloy Fdry. Co., Elizabeth, N. J.
Crane Co., Chicago, Ill.
Driver Harris Co., Harrison, N. J.
Duraloy Co., Scottdale, Pa.
Duriron Co., Inc., Dayton, Ohio
Electric Steel Fdry. Co., Portland, Ore.
Electro-Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio
Empire Steel Castings, Inc., Reading, Pa.
General Alloys Co., Boston, Mass.
General Metals Corp., Oakland, Calif.
Grede Foundries, Milwaukee, Wis.
Haynes Stellite Co., Kokomo, Ind.
Hoskins Mfg. Co., Detroit, Mich.
Key Co., East St. Louis, Ill.
Lebanon Steel Fdry., Lebanon, Pa.
Michiana Products Corp., Michigan City, Ind.
Michigan Steel Casting Co., Detroit, Mich.
Midvale Co., Philadelphia, Pa.
Milwaukee Steel Fdry., Milwaukee, Wis.
National Alloy Div., Blaw-Knox Co., Blawknox, Pa.
Ohio Steel Fdry. Co., Cincinnati, Ohio
Otis Elevator Co., Buffalo, N. Y.
Pacific Fdry. Co., Ltd., San Francisco, Calif.
Shawinigan Chemicals, Ltd., Montreal, Que.
Sivyer Steel Casting Co., Milwaukee, Wis.
Standard Alloy Co., Cleveland, Ohio
Sterling Alloys Inc., Woburn, Mass.

Materials	Manufacturer	Description	Most Important Applications
Stainless Type HN	Symington-Gould Corp., Rochester, N. Y.	Fe; 18-22 Cr; 23-26 Ni	
Stainless Type HP	Taylor Wharton Iron & Steel Co., High Bridge,	Fe; 28-32 Cr; 29-31 Ni	Hot gases.

Stainless Type HL	Sterling Alloys Inc., Woburn, Mass.	Fe; 26-32 Cr; 19-22 Ni	
Stainless Type HN	Symington-Gould Corp., Rochester, N. Y.	Fe; 18-22 Cr; 23-26 Ni	Hot gases.
Stainless Type HP	Taylor Wharton Iron & Steel Co., High Bridge, N. J.	Fe; 28-32 Cr; 29-31 Ni	
Stainless Type HS		Fe; 8-12 Cr; 29-32 Ni	
Stainless Type HT	Utility Electric Steel Fdry., Los Angeles,	Fe; 13-17 Cr; 33-37 Ni	Carburizing service.
Stainless Type HU	Warman Steel Casting Co., Huntington Park,	Fe; 17-21 Cr; 37-41 Ni	Carburizing service.
Stainless Type HW	Calif.	Fe; 10-14 Cr; 58-62 Ni	Carburizing service.
Stainless Type HX		Fe; 15-19 Cr; 64-68 Ni	Carburizing service.
Still Metal	Amer. Manganese Bronze Co., Philadelphia, Pa.		
Stoody 1	Stoody Co., Whittier, Calif.	Non-ferrous; Co, Cr, W welding rod	Severe abrasion and heat with sulphuric, nitric, acetic acids; chlorides.
Stoody 6	Stoody Co., Whittier, Calif.	Non-ferrous; Co, Cr, W welding rod	Abrasion, heat, impact with sulphuric, nitric, acetic acids; chlorides.
Super Nickel	Amer. Brass Co., Waterbury, Conn.	70 Cu; 30 Ni	
Tantalum	Fansteel Metallurgical Corp., North Chicago, Ill.	99.9 + Ta	Hydrochloric, nitric, sulphuric, hydrobromic acids; hydrogen peroxide; ferric chloride.
Telnic Bronze	Chase Brass and Copper Co., Waterbury, Conn.	98.3 Cu; 1 Ni; 0.2 P; 0.5 Te	
Thermalloy Stainless	Electro Alloys Div., Amer. Brake Shoe Co., Elyria, Ohio	Various standard heat resistant stainless steels.	
Tisco 150 Alloy	Taylor-Wharton Iron and Steel Co., Easton, Pa.		
Tisco Timang Mn Ni Steel	Taylor-Wharton Iron and Steel Co., Easton, Pa.		
Tisco Mn Steel	Taylor-Wharton Iron and Steel Co., Easton, Pa.	Fe; 12 Mn (Hadfield type)	
Toncan Cu Mo Iron	Republic Steel Corp., Cleveland, Ohio		
Tophet A	Wilbur B. Driver Co., Newark, N. J.	80 Ni; 20 Cr	
Tophet C	Wilbur B. Driver Co., Newark, N. J.	Fe; 60 Ni; 15 Cr	
Tophet D	Wilbur B. Driver Co., Newark, N. J.	Fe; 35 Ni; 18.5 Cr	
Tri-Clover	Tri-Clover Machine Co., Kenosha, Wis.	Various standard stainless steel fittings.	
Tube Borium	Stoody Co., Whittier, Calif.		
Tuf-Stuf	Mueller Brass Co., Port Huron, Mich.	86.9 Cu; 10 Al; 3 Fe; 0.1 Mn	
U.S.S. Stainless	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.	Various standard stainless steels.	
Utiloy Stainless	Utility Electric Steel Fdry., Los Angeles, Calif.	Various standard stainless steels.	
Utiloy 20	Utility Electric Steel Fdry., Los Angeles, Calif.	20 Cr; 29 Ni; 1.75 Mo; 0.07 max. C	Sulphuric acid; oxidizing and reducing solutions.
Utiloy 100	Utility Electric Steel Fdry., Los Angeles, Calif.	98 Ni; 1 Si; 0.25 C	Rayon mfg.; caustics.
Utiloy H	Utility Electric Steel Fdry., Los Angeles, Calif.	22-26 Cr; 11-13 Ni; 0.3 C	Hot oxidizing gases; furnace parts; oil still tube supports; cement mill retaining rings.
Utiloy NH	Utility Electric Steel Fdry., Los Angeles, Calif.	14-17 Cr; 34-37 Ni; 0.2-0.6 C	Heat treating boxes; cyanide pots; enamel furnace parts.
Vanadium Stainless	Vanadium Alloys Steel Co., Latrobe, Pa.	Various standard stainless steels.	
Worthite	Worthington Pump and Machinery Corp., Harrison, N. J.	Fe; 20 Cr; 24 Ni; 0.07 max. C; 3.25 Si; 3 Mo; 1.75 Cu; 0.6 Mn	Sulphuric, nitric, phosphoric, acetic acids; sulphate and sulphite paper liquors; citrus juices.
Wrought Iron	A. M. Byers Co., Pittsburgh, Pa.	Fe; 0.03 max. C; 0.05 max. Mn; 0.10-0.12 P; 0.025 max. S; 0.10-0.15 Si; 2.5-3.0 slag	Water; steam and condensate; brines; soil; caustics; corrosive atmospheres.
Wyndaloy	Wyndale Mfg. Corp., Indianapolis, Ind.		

CARBON & GRAPHITE

Impervite	General Ceramics and Steatite Corp., Keasbey, N. J.	Resin impregnated graphite. Mostly for heat exchangers.	Hydrochloric, hydrofluoric, phosphoric, chromic, organic acids; ferric chloride.
International	International Graphite and Electrode Corp., St. Mary's, Pa.	Graphite. Electrodes and various shapes.	
Karbate (Carbon)	National Carbon Co., Cleveland, Ohio	Impervious carbon. } Pipe, fittings, valves, pumps, heat exchangers, towers and auxiliary parts, tanks, brick, plates, tubes, special shapes, seal rings, injection parts	Hydrochloric, sulphuric, phosphoric acids; chlorinated organics; sodium hydroxide; nitric-hydrofluoric acid mixtures.
Karbate (Graphite)	National Carbon Co., Cleveland, Ohio	Impervious graphite. }	
Kempruf Carbon Brick	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Dense carbonaceous material.	Hydrofluoric acid; sodium hydroxide.
National Kempruf	National Carbon Co., Cleveland, Ohio	Carbon. } Brick, plates, tubes, cylinders, beams, Raschig rings, pipe, fittings, towers and auxiliary parts, molds, bushings, special shapes.	Hydrochloric, sulphuric, phosphoric acids; sodium hydroxide; nitric-hydrochloric acid mixtures; chlorinated organics.
National Acheson	National Carbon Co., Cleveland, Ohio	Graphite. }	
Speer	Speer Carbon Co., St. Mary's, Pa.	Carbon and graphite. Brick, plates, blocks, tubes, cylinders, bushings, shapes.	

Materials	Manufacturer	Description	Most Important Applications
Stackpole	Stackpole Carbon Co., St. Mary's, Pa.	Carbon and graphite. Tubes, pipe, rods, plates, bearings, seal rings, crucibles, heat treating boxes and molds.	
Stackpole	Stackpole Carbon Co., St. Mary's, Pa.	Impervious graphite. Pipe, bearings, seal rings, special shapes (injector body and nozzles).	

CEMENT, MORTAR, PUTTY

Acichlor	Pecora Paint Co., Philadelphia, Pa.	Firm putty.	Hydrochloric, oxalic, nitric acids; ammonia; ammonium chloride; caustic soda.
Acidol	The Sullivan Co., Memphis, Tenn.	Pouring cements.	
Acilite	Pecora Paint Co., Philadelphia, Pa.	Ready mixed cement; troweling.	Hydrochloric, acetic, sulphuric, nitric acids; ammonium chloride; benzol.
Alk-Li-Pruf	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Alkali-resistant, synthetic-type cement.	Alkalis; sulphuric, hydrofluoric, hydrochloric, most organic acids; most organic solvents.
Alkor	Atlas Mineral Products Co., Mertztown, Pa.	Furan derivative; carbon aggregate.	Sulphuric, hydrochloric, hydrofluoric, organic acids; corrosive salts; alkalis.
Asplit	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Self-hardening resin cement.	Acids except high oxidizing acids and hydrofluoric.
Basolit, Carbon	Nukem Products Corp., Buffalo, N. Y.	Carbon-sulphur cement.	Hydrofluoric, nitric acids.
Basolit, Standard	Nukem Products Corp., Buffalo, N. Y.	Sulphur silicate based cement.	Sulphuric, hydrochloric, other mineral acids except hydrofluoric.
Brimsto	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Sulphur-base, hard setting, smooth-surfaced cement.	Acetic, citric, lactic, hydrochloric, sulphuric, phosphoric acids.
Carbo-Plx Carbo-Flex Carbo-Insulate Carbo-Mold	Carboline Co., St. Louis, Mo.	(Carbon) Room temperature, thermo-setting carbon cements.	Acetic, hydrochloric, sulphuric acids; benzol; chlorinated hydrocarbons; sodium hydroxide.
Carbo-Korez	Atlas Mineral Products Co., Mertztown, Pa.	Phenol-formaldehyde; carbon aggregate.	Sulphuric, hydrochloric, hydrofluoric, phosphoric, organic acids; corrosive salts.
Carbo Vitrobond	Atlas Mineral Products Co., Mertztown, Pa.	Sulphur-Thiokol cement.	Sulphuric, nitric, hydrochloric, hydrofluoric acids; corrosive salts.
Carolina	Charlotte Chemical Laboratories, Charlotte, N. C.	Acidproof cement.	
Causplit	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Self-hardening resin cement.	Most acids and alkalis except high oxidizing acids.
Ceilcote Resin Cement	Ceilcote Co., Cleveland, Ohio	Furan resin cement with silica and carbon fillers.	Acids; alkalis; salts; esters; most hydrocarbon solvents.
Charlab	Charlotte Chemical Laboratories, Charlotte, N. C.	Chemical putty	
Chemstone	Johns-Manville Sales Corp., New York, N. Y.	Pressed sheets made from asbestos, cement and inert mineral filler.	Mild acids and alkalis.
Compo-Bond	Ceilcote Co., Cleveland, Ohio	Silicate bonding cement, liquid and powder.	Mineral acids; salts; hydrocarbons; mixed acids.
Duralon	U. S. Stoneware Co., Akron, Ohio	Furan base resin cements.	
Durasite	U. S. Stoneware Co., Akron, Ohio	Furan base resin cements.	
Duro Standard	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Hard, dense, silicate-type cement.	Sulphuric, hydrochloric, nitric, phosphoric acids; sulphur dioxide; all salts in presence of acid.
Duro XXX(Triplex)	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Exceedingly dense, silicate-type cement	
Filtros	Filtros Inc., East Rochester, N. Y.	Acidproof cement.	
Kemo Paste	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Mineral-type filler for portland cement. (Makes it appreciably acid resistant.)	
Korez	Atlas Mineral Products Co., Mertztown, Pa.	Phenol-formaldehyde; silica aggregate.	Sulphuric, hydrochloric, phosphoric; organic acids; corrosive salts and gases.
Lumnite	Lumnite Div., Universal Atlas Cement Co., New York	Hydraulic cement; powder for mixing with aggregate and water to make concrete.	Weak sulphuric, lactic, carbonic acids.
N-380 Silicate	Philadelphia Quartz Co., Philadelphia, Pa.	Sodium silicate; to be combined with special proprietary quick-setting cements at time of use.	Sulphuric or any other acid, including organic, except hydrofluoric.
N-Series	Union Bay State Chemical Co., Cambridge, Mass.	Neoprene base cements.	
Nu Mastic	Nukem Products Corp., Buffalo, N. Y.	Asphalt base, high temperature cement.	Hydrochloric, sulphuric, nitric, hydrofluoric acids; alkalis.
Nukem All-Purpose	Nukem Products Corp., Buffalo, N. Y.	Resinous cement; chemical setting.	Sulphuric, hydrochloric, hydrofluoric acids; alkalis.
Nukem Silicate	Nukem Products Corp., Buffalo, N. Y.	Silicate cement.	All acids except hydrofluoric.
Pecomastic	Pecora Paint Co., Philadelphia, Pa.	Putty; troweling; brushing.	Hydrochloric; acetic, sulphuric acids; caustic soda; ammonia; ammonium chloride.
Penchlor Acid-Proof	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Chemical setting silicate cement.	Most acids except hydrofluoric.
Penchlor Acid-Proof S25	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Chemical setting silicate cement.	Conc. sulphuric acid.
Penchlor Acid-Proof, Pfaudler Grade	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Chemical setting, low porosity silicate cement.	Glass-lined vessel repairs.

Penchlor Fire-Proof	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Chemical setting silicate cement.	Acids.
Pennsalt HF and HFK	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Self-hardening resin cement.	Food acid; phosphoric, hydrofluoric acids.
Pennsalt PRF and PRFK	Pennsylvania Salt Mfg. Co., Philadelphia, Pa.	Self-hardening resin cement.	Most acids, alkalis and solvents except some high oxidizing acids.
Permanite	Maurice A. Knight, Akron, Ohio	Furane base resin cement.	
Plastite	U. S. Stoneware Co., Akron, Ohio	Caulking putty.	
Plasul Basolit	Nukem Products Corp., Buffalo, N. Y.	Plasticized sulphur-silicate cement	Sulphuric, hydrochloric, nitric acids
Porox	Patterson Fdry. & Machine Co., East Liverpool, Ohio	Silicate cement.	
Quigley	Quigley Co., New York, N. Y.	Acidproof cements.	
Reardon	Reardon Industries, Cincinnati, Ohio	Acidproof cement.	
Redux	Resinous Products & Chemicals Co., Philadelphia, Pa.	Metal-to-metal resin adhesive.	
Sauereisen 31	Sauereisen Cement Co., Pittsburgh, Pa.	Acidproof cement. Sodium silicate base.	Acids except hydrofluoric; solvents; water; oil.
Sauereisen 44	Sauereisen Cement Co., Pittsburgh, Pa.	Acid tank sealer. Non-hardening bituminous base plastic.	Acids except hydrofluoric; water.
Sauereisen 46	Sauereisen Cement Co., Pittsburgh, Pa.	Hydrofluoric acid cement. Zirconium base melting compound.	All acids; solvents; alkalis; water.
Sauereisen 48	Sauereisen Cement Co., Pittsburgh, Pa.	Joint compound. Sulphur base melting compound.	Acids except hydrofluoric; solvents; alkalis; water.
Sauereisen 49	Sauereisen Cement Co., Pittsburgh, Pa.	Resin base melting compound.	Acids except hydrofluoric; solvents; alkalis; water.
Sealtex	Nukem Products Corp., Buffalo, N. Y.	Cold setting rubberized asphaltic compound.	Hydrochloric, sulphuric, nitric, hydrofluoric acids; alkalis.
S Special Silicate	Philadelphia Quartz Co., Philadelphia, Pa.	Low alkaline silicate for use with silica cements.	Sulphuric acid; any acid including organic except hydrofluoric.
Stackpole	Stackpole Carbon Co., St. Mary's, Pa.	Carbonaceous cements for carbon, graphite, and carbon-to-metal joints.	
Staminite	Robinson Clay Product Co., Akron, Ohio	Acidproof cement.	
Sulsilo	The Sullivan Co., Memphis, Tenn.	Pre-mixed silicate cement.	
Syntho	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Dense, impervious, synthetic-type cement.	Hydrofluoric acid; most organic solvents; organic acids; corrosive salts; weak alkalis; some strong alkalis.
Thiokol	Thiokol Corp., Trenton, N. J.	Liquid (100% solids) rubber polymers.	
Transite	Johns-Manville Sales Corp., New York, N. Y.	Asbestos fiber and cement combined under pressure. Pipe, flat and corrugated sheet.	Acid and alkaline fumes.
Vitrex	Atlas Mineral Products Co., Mertztown, Pa.	Sodium silicate; sets by chemical reaction.	Sulphuric, nitric, hydrochloric acids; corrosive gases.
Vitrobond	Atlas Mineral Products Co., Mertztown, Pa.	Sulphur-Thiokol cement.	Sulphuric, nitric, hydrochloric, phosphoric acids; corrosive salts and gases.

CERAMICS

Aco	Custodis Construction Co., New York, N. Y.	Acidproof brick and packing rings.	
Alsop Glass Lining	Alsop Engineering Co., Milldale, Conn.	Glass-lined tanks, mixers and filters.	
Amersil Fused Silica	Amersil Co., Inc., Hillside, N. J.	Fused silica ware. Pans, pipes, gas coolers, absorbers, insulators, tubes, plates.	
Carrara	Pittsburgh Plate Glass Co., Pittsburgh, Pa.	Structural glass, flat or bent.	
Ceratherm	U. S. Stoneware Co., Akron, Ohio	Ceramic ware. Process equipment.	
Ceraware	General Ceramics and Steatite Corp., Keasbey, N. J.	Chemical stoneware. Towers, tanks, pumps, etc.	Hot, wet chlorine; hydrochloric, nitric acids; hydrogen peroxide; bromine; sodium hypochlorite.
Cerawite	General Ceramics and Steatite Corp., Keasbey, N. J.	Chemical porcelain. Piping, valves, etc.	Hydrogen peroxide; hydrochloric, nitric, organic, sulphuric acids; aqua regia.
Duro	Electro Chemical Supply and Engineering Co., Paoli, Pa.	Vitreous, acidproof brick.	Sulphuric, hydrochloric, nitric, acetic acids; sodium hydroxide; all salts.
Fiberglas	Owens-Corning Fiberglas Corp., Toledo, Ohio	Fibrous glass cloth and mat. Air filters, thermal insulation, tower packing, filter cloth.	
Glascote	Glascote Products, Inc., Cleveland, Ohio	Borosilicate glass lining fused to steel.	Hydrochloric, organic, sulphuric, nitric acids; chlorine; pharmaceuticals.
Hanovia Fused Quartz	Hanovia Chemical & Mfg. Co., Newark, N. J.	Transparent fused quartz in all shapes.	
Illinois	Illinois Electric Porcelain Co., Macomb, Ill.	Ceramic chemical porcelain. Pipe, valves, fittings.	Acids (except hydrofluoric).
Knight-Ware	Maurice A. Knight, Akron, Ohio.	Chemical stoneware. Tanks, kettles, pipe, fittings, valves, pumps, coils, filters, etc.	
Lapp Porcelain	Lapp Insulator Co., Le Roy, N. Y.	Chemical porcelain. Pipe, fittings, valves, tower packing, special shapes.	Hydrochloric, sulphuric, nitric acids; mixed acids; chlorinated hydrocarbons; wet chlorine.
Locke Porcelain	Locke Inc., Baltimore, Md.	Chemical porcelain. Balls for ball mills, brick, piping, valves, containers.	All acids except hydrofluoric.
Pennvernon	Pittsburgh Plate Glass Co., Pittsburgh, Pa.	Window glass, flat.	
Permaglas	A. O. Smith Corp., Milwaukee, Wis.	Glass-lined steel equipment.	
Pfaudler	The Pfaudler Co., Rochester, N. Y.	Glass-lined steel equipment. Tanks, pipe, fittings, valves.	Hydrochloric, sulphuric, nitric, phosphoric, acetic, chromic acids.

Materials	Manufacturer	Description	Most Important Applications
Pittsburgh Plate Glass	Pittsburgh Plate Glass Co., Pittsburgh, Pa.	Polished plate glass, flat or bent.	
Pyrex	Corning Glass Works, Corning, N. Y.	Glass. Pipe, fittings, sight glasses, gage glasses, heat resistant plate.	
"U. S." Chemical Stoneware	U. S. Stoneware Co., Akron, Ohio	Chemical stoneware. Tanks, kettles, pipe, fittings, valves, pumps, coils, filters, etc.	
Vitreo	Vitreous Steel Products Co., Cleveland, Ohio	Porcelain enamel drying trays.	Blue trays: neutral salts and solutions; brown trays: acids except hydrofluoric and certain grades of hot phosphoric.
Vitreosil	The Thermal Syndicate Ltd., New York, N. Y.	Vitreous silica, approx. 99.8% silica; pipes and vessels up to 50 gal. capacity; 30 in. dia., 10 ft. length.	Hydrochloric, phosphoric, perchloric, nitro-hydrochloric acids; chlorine; phosgene.
Vitreous Enamel	Vitreous Enameling & Stamping Co., New York, N. Y.	Enameled tanks and specialties.	
Vycor	Corning Glass Works, Corning, N. Y.	96% Silica glass. Tubing, rods, flat ware, various shapes.	
PLASTICS			
Ace Saran	Amer. Hard Rubber Co., Butler, N. J.	Vinylidene chloride. Pipe, fittings, tubing.	Sulphuric, hydrochloric, nitric acids; phenol; hydrocarbons.
Ace Parian	Amer. Hard Rubber Co., Butler, N. J.	Polyethylene. Pipe, fittings, tubing.	Sulphuric, hydrochloric acids; caustics; ethylene dichloride; acetone.
Catalin	Catalin Corp. of Amer., New York, N. Y.	Cast phenol-formaldehyde resin.	Sulphuric, phosphoric, nitric, acetic acids; aliphatic hydrocarbons; copper sulphate.
Ceilcote	Ceilcote Co., Cleveland, Ohio	Cut-back of asphalts, resins plasticizer and fillers.	Bases; salts; mineral and some organic acids; chlorine; sulphur dioxide.
Celcon	Celanese Plastics Corp., New York, N. Y.	Ethyl cellulose.	
Celluloid	Celanese Plastics Corp., New York, N. Y.	Cellulose nitrate.	
Celoron	Continental-Diamond Fibre Co., Newark, Del.	Molded, laminated or macerated plastics.	Acids; alkalis.
Compar	Resistoflex Corp., Belleville, N. J.	Solution of compounded polyvinyl alcohol. Solution for dipping or painting.	
DC 2103	Dow Corning Corp., Midland, Mich.	Silicone bonding resin for plastic laminates.	Sulphuric, hydrochloric, chromic acids; sodium hydroxide; hydrogen peroxide.
Dilecto	Continental-Diamond Fibre Co., Newark, Del.	Laminated sheets, rods and tubes.	Acetic, hydrochloric, sulphuric acid.
Formica CN-7	Formica Insulation Co., Cincinnati, Ohio	Fabric base phenolic laminated with chemical resistant resin.	Acid electro-plating solutions except chromic acid; viscose rayon setting solutions.
Formica CN-22	Formica Insulation Co., Cincinnati, Ohio	Fabric base phenolic laminated with chemical resistant resin.	Alkaline electro-plating solutions.
Formica LN-41	Formica Insulation Co., Cincinnati, Ohio	Fine weave fabric laminated with melamine resin.	Alkaline electro-plating solutions such as cadmium.
Forticel	Celanese Plastics Corp., New York, N. Y.	Cellulose propionate.	
Geon	B. F. Goodrich Chemical Co., Cleveland, Ohio	Polyvinyl chloride plastics.	Sodium hydroxide; ferric chloride; nitric, hydrochloric acids; aromatic, aliphatic hydrocarbons.
Haveg 41	Haveg Corp., Newark, Del.	Rigid thermosetting plastic.	Inorganic acids; salts.
Haveg 43	Haveg Corp., Newark, Del.	Rigid thermosetting plastic.	Hydrofluoric acid and its compounds.
Haveg 48	Haveg Corp., Newark, Del.	Rigid thermosetting plastic.	Inorganic acids and salts; hydrofluoric acid.
Haveg 60	Haveg Corp., Newark, Del.	Rigid thermosetting plastic.	Inorganic and organic acids; salts; alkalis; solvents.
Haveg 63	Haveg Corp., Newark, Del.	Rigid thermosetting plastic.	Hydrofluoric acid and its compounds.
Heresite	Heresite & Chemical Co., Manitowoc, Wis.	Pure synthetic phenol - formaldehyde resin.	Sulphuric acid.
Insurok	Richardson Co., Melrose Park, Ill.	Molded and laminated plastics. Sheet, rod, tube, fabricated parts, special moldings.	
Koroseal	B. F. Goodrich Co., Akron, Ohio	Plasticized polyvinyl chloride. Sheet lining; packing.	Chromic, nitric acid; chrome plating solutions.
Kriston	B. F. Goodrich Chemical Co., Cleveland, Ohio	Allyl ester thermosetting materials.	
Lamicoid	Mica Insulator Co., Schenectady, N. Y.	Phenolic laminate, fabric base. Sheets	
Lucite	E. I. du Pont de Nemours & Co., Wilmington, Del.	Acrylic resin; sheets, rods, tubes, moldings.	Weak alkalis and acids; aliphatic hydrocarbons.
Lumarith	Celanese Plastics Corp., New York, N. Y.	Cellulose acetate.	
Micarta	Westinghouse Electric Corp., Pittsburgh, Pa.	Laminated plastics, fabric or kraft base. Sheets, channels, angles, molded shapes.	Mild acids, alkalis; organic solvents; water; atmospheric conditions.
Nixon CA (Nixonite)	Nixon Nitration Works, Nixon, N. J.	Cellulose acetate. Sheets, rods, molding powders.	
Nixon CN (Nixonoid)	Nixon Nitration Works, Nixon, N. J.	Cellulose nitrate. Sheets, rods, tubes.	
Nixon EC	Nixon Nitration Works, Nixon, N. J.	Ethyl cellulose. Molding powders.	
Nukemite	Nukem Products Corp., Buffalo, N. Y.	Synthetic resin sheet and coating.	
Nylon	E. I. du Pont de Nemours & Co., Wilmington, Del.	Polyamides; flake, sheet, extrusions, moldings; brush filament.	Alkalis; esters; ketones; some types resistant to alcohols, most solvents and weak acids.

Panelyte	St. Regis Paper Co., New York, N. Y.	Laminated resinous plastic. Sheets, rods, tubes, fabri-	Oils; organic solvents; mild acids and alkalis.

Panelyte	St. Regis Paper Co., New York, N. Y.	Laminated resinous plastic. Sheets, rods, tubes, fabricated parts, etc.	Oils; organic solvents; mild acids and alkalis.
Permanite	Maurice A. Knight, Akron, Ohio	Furane base resin. Laminates, fabricated shapes.	
Phenolite	National Vulcanized Fibre Co., Wilmington, Del.	Laminated phenolics. Sheet, tube, rod.	
Plexene	Rohm & Haas Co., Philadelphia, Pa.	Modified styrene copolymer molding powder.	
Plexiglas	Rohm & Haas Co., Philadelphia, Pa.	Acrylic resin. Cast sheets, rods, molding powder.	Battery solutions; hydraulic fluids; writing inks.
Polythene	E. I. du Pont de Nemours & Co., Wilmington, Del.	Polyethylene. Sheet, rod, tube, molding powders, film, filament. Pipe, pipe lining, gaskets, etc.	Chrome plating solutions; hydrofluoric acid; caustic soda; sulphur dioxide fumes; hypochlorite sol.; carbon disulphide.
Pyroflex Construction	Maurice A. Knight, Akron, Ohio	Thermoplastic resin lining plus steel, brick, etc. to make a functional unit.	Relatively strong alkalis and acids; most nonhydrocarbon solvents; water.
Resilon	U. S. Stoneware Co., Akron, Ohio	Bituminous linings and membranes.	
Resistoflex	Resistoflex Corp., Belleville, N. J.	Compounded modified polyvinyl alcohol. Hose, sheet, molded parts.	
Saran	Dow Chemical Company, Midland, Mich.	Vinyl chloride-vinylidene chloride copolymer. Pipe, pipe fittings, tube, tube fittings.	Aromatic and aliphatic hydrocarbons; halogenated derivatives; ketones except acetone; esters; monohydroxy alcohols higher than propanol.
Sauereisen No. 44	Sauereisen Cement Co., Pittsburgh, Pa.	Bituminous base, non-hardening plastic. Impervious linings on tanks, sewers, etc.	
Sealon	Maurice A. Knight, Akron, Ohio	Polyvinyl chloride elastomer. Tank linings, sheets, gaskets.	Water; acids except hydrofluoric.
Synthane	Synthane Corp., Oaks, Pa.	Fabrics, paper or asbestos bonded with phenolic or melamine resin.	
Teflon	E. I. du Pont de Nemours & Co., Wilmington, Del.	Polymerized tetrafluoroethylene. Rods, tubes, sheets, beading, gaskets, thin tapes.	Most acids and bases.
Tenite I	Tennessee Eastman Corp., New York, N. Y.	Cellulose acetate thermoplastic molding material.	Hydrochloric, nitric, sulphuric, hydrofluoric acids; chlorine, sulphur dioxide.
Tenite II	Tennessee Eastman Corp., New York, N. Y.	Cellulose acetate butyrate thermoplastic molding material.	
Textolite Cold Molded	General Electric Co., Pittsfield, Mass.	Cement, bitumen or phosphoric acid base. Asbestos filled.	Fair resistance Water; dilute acids, bases, salts; aliphatic petrol. prods.;
Textolite Laminated	General Electric Co., Pittsfield, Mass.	Phenolic, melamine and silicone laminates. Paper, fabric, asbestos or glass base.	Good resistance fats; waxes.
Textolite Molded	General Electric Co., Pittsfield, Mass.	Phenolic, modified phenolic or rubber phenolic. Wood flour, cotton flock, rag or mineral filled.	Mild alkalis.
Tygon	U. S. Stoneware Co., Akron, Ohio	Synthetic compounds. Linings, tubing, etc.	Dilute acids; bases; hydrocarbons; rayon precipitates; inorganic solvents; alcohol.
Vinlite	Celanese Plastics Corp., New York, N. Y.	Mesh reinforced plastic.	
Vulcanized Fibre	National Vulcanized Fibre Co., Wilmington, Del.	Sheets, tubes, rod.	
Westinghouse Micarta	Westinghouse Electric Corp., Pittsburgh, Pa.	Laminated sheets, rods, tubes, special shapes.	
Zerok	Atlas Mineral Products Co., Mertztown, Pa.	Polyvinyl chloride. Tank linings and coatings.	Mild acids; alkalis; organic solvents; water; atmosphere.
			Sulphuric, nitric, hydrofluoric acids; alkalis.

RUBBER

Ace Hard Rubber	Amer. Hard Rubber Co., Butler, N. J.	Vulcanized rubber. Rod, sheet, tube, molded parts, linings, pipe, fittings, etc.	Sulphuric, hydrochloric, phosphoric; acetic acids; caustics; salt solutions.
Ace Soft Rubber	Amer. Hard Rubber Co., Butler, N. J.	Soft rubber. Linings, molded parts.	
Acidseal E	B. F. Goodrich Co., Akron Ohio	Natural rubber sheet lining for tanks and misc. metal parts.	Sulphuric, hydrochloric, phosphoric acids; caustics; salt solutions.
Acidseal MA and PA	B. F. Goodrich Co., Akron Ohio	Natural rubber sheet lining for tanks and misc. metal parts.	Bleach solutions; highly corrosive acid mixtures.
Armstrong	Armstrong Cork Co., Lancaster, Pa.	Buna-N base gaskets.	Hydrochloric and phosphoric acids; respectively.
Armstrong	Armstrong Cork Co., Lancaster, Pa.	Neoprene base gaskets.	Aromatic fuels; petroleum and vegetable oils; alkalis; mild acids; alcohols; inorganic salts.
Armstrong	Armstrong Cork Co., Lancaster, Pa.	Thiokol base gaskets.	Alkalis; inorganic salts; mild acids; vegetable and refined petroleum oils.
Armstrong	Armstrong Cork Co., Lancaster, Pa.	Cork-buna N base gaskets.	Aromatic solvents; common alcohols.
Armstrong	Armstrong Cork Co., Lancaster, Pa.	Cork-neoprene base gaskets.	Aromatic fuels; vegetable and petroleum oils.
Boston	Boston Woven Hose & Rubber Co., Boston, Mass.	Cork-Thiokol gaskets.	Vegetable and petroleum oils.
Butyl (GR-I)	Stanco Distributors, Inc., New York, N. Y.	Conveyor and transmission belt, hose, mechanical goods.	Aromatic solvents; common alcohols.
Crane	Crane Packing Co., Chicago, Ill.	Solid copolymer of isobutylene and isoprene.	
Custoplast	Custodis Construction Co., New York, N. Y.	Packing and mechanical seals.	
Dayton	Dayton Rubber Mfg. Co., Dayton, Ohio	Soft rubber and neoprene tank linings.	
Firestone	Firestone Tire & Rubber Co., Akron, Ohio	Oilproof rubber belt, transmission belt.	
		Vibration dampeners, adhesives, sheet, tape, hose, belting, fabric, moldings, extrusions.	

Materials	Manufacturer	Description	Most Important Applications
Garlock	Garlock Packing Co., Palmyra, N. Y.	Gaskets, packings, moldings, Klozure oil seals.	
Gates	Gates Rubber Co., Denver, Colo.	Belts, hose, moldings.	
G. E. Silicone Rubber	General Electric Co., Pittsfield, Mass.	Sheets, extruded shapes, molded parts, coating pastes, foam, gaskets.	Dilute acids and alkalis; mineral oils; chlorinated hydrocarbons; organic peroxides; alcohols.
Greene-Tweed	Greene, Tweed & Co., New York, N. Y.	Packing, gaskets, sheet.	
Herecrol	Heresite & Chemical Co., Manitowoc, Wis.	Butadiene acrylonitrile product. Vulcanized or uncompounded.	Hydrochloric acid.
Hewitt	Hewitt Rubber Div., Hewitt-Robins, Inc., Buffalo, N. Y.	Hose, belting.	Acid; alkali; air; water; steam.
Hycar	B. F. Goodrich Chemical Co., Cleveland, Ohio	Nitrile type synthetic rubber.	Aromatic, aliphatic hydrocarbons; sodium hydroxide; ammonia; ferric chloride; sulphuric and fatty acids.
Jenkins	Jenkins Bros. Rubber Div., Bridgeport, Conn.	Mechanical goods, packing, valve disks, tape, moldings, extrusions.	
Johns Manville	Johns-Manville Sales Corp., New York, N. Y.	Gaskets.	
Linear	Linear Packing & Rubber Co., Philadelphia, Pa.	Packing.	
Luzerne	Luzerne Rubber Co., Trenton, N. J.	Hard rubber pipe, fittings, valves, shapes, tanks, lining.	Alkalis; hydrochloric, sulphuric, nitric acids.
Manhattan	Manhattan Rubber Mfg. Div., Passaic, N. J.	Crude and synthetic rubber linings.	Inorganic acids (except highly oxidizing), salts, alkalis; organics except aliphatic, aromatic and chlorinated hydrocarbons.
Neobon	Atlas Mineral Products Co., Mertztown, Pa.	Neoprene-base lining for tanks, fans, fume ducts, etc.	Sulphuric, hydrochloric, hydrofluoric, phosphoric acids; alkalis; corrosive salts.
Neoprene	E. I. du Pont de Nemours & Co., Wilmington, Del.	Polymer of chloroprene. Crude neoprene for compounding and curing.	Hydrochloric, sulphuric, acetic acids; caustic; inorganic salts; plating solutions.
Neoprene	Custodis Construction Co., New York, N. Y.	Synthetic rubber acidproof membrane.	Sulphuric, hydrochloric acids; caustic soda; bleach solutions, alcohols.
Paramount	Paramount Rubber Co., Detroit, Mich.	Neoprene, buna-S, natural rubber. Sheets for tank lining.	
Parlon	Hercules Powder Co., Wilmington, Del.	Chlorinated rubbers. Used as a base for concrete paints.	
Perbunan (GR-A)	Stanco Distributors, Inc., New York, N. Y.	Copolymer of butadiene and acrylonitrile. Solid sheets.	
Permobond Natural (soft)	U. S. Rubber Co., New York, N. Y.	Linings for tanks, pipes, fittings, valves.	
Permobond Natural (hard)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-S (soft)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-S (hard)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-A (soft)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-A (hard)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-M (soft)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-P (soft)	U. S. Rubber Co., New York, N. Y.		
Permobond GR-I	U. S. Rubber Co., New York, N. Y.		
Plioweld	Goodyear Tire & Rubber Co., Akron, Ohio	Rubber-lined tanks, pipe, etc.	
Rewbon	Atlas Mineral Products Co., Mertztown, Pa.	Natural rubber.	Sulphuric, hydrochloric, hydrofluoric, phosphoric acids; alkalis; corrosive salts.
Saniprene	B. F. Goodrich Co., Akron, Ohio	Natural rubber sheet lining for tanks and misc. metal parts.	Food products.
Self Vulcanizing	Self Vulcanizing Rubber Co., Chicago, Ill.	Linings and coatings.	
Silastic	Dow Corning Corp., Midland, Mich.	Silicone rubber compounded with inorganic fillers.	Hot oils; ozone; hydrochloric, nitric, sulphuric acids; sodium hydroxide.
Superflexite	B. F. Goodrich Co., Akron, Ohio	Flexible, natural rubber sheet lining for tanks and misc. metal parts.	
Stokes	Stokes Molded Prods., Trenton, N. J.	Hard rubber pipe, containers, fittings, misc. moldings and extrusions.	Acids; metallic salt solutions; chlorine solutions; ammonia; caustics.
Tensilgrip	Amer. Wringer Co., Woonsocket, R. I.	Natural and synthetic rubber lined tanks, pipe, pumps, ducts, etc.	
Thermoid	Thermoid Rubber Div., Trenton, N. J.	Rubber hose; various types.	Ammonia; beer and wine; butane-propane gas; CO_2; lactic acid; hydraulic oils; oil and gasoline; lacquers; steam.
Thiokol	Thiokol Corp., Trenton, N. J.	Organic polysulphide rubber. Forms: solid, water dispersion or viscous liquid.	Aliphatic and aromatic hydrocarbons; chlorinated compounds; ketones.
Triflex	B. F. Goodrich Co., Akron, Ohio	Hard rubber layer sandwiched between two soft rubber layers. Sheet lining for tanks and misc. metal parts.	Pickling solutions; alum; hydrochloric and sulphuric acids.
Vistanex	Stanco Distributors, Inc., New York, N. Y.	Polymerized isobutylene. Viscous liquid to solid, depending on mol. wt.	
Vulcalock	B. F. Goodrich Co., Akron, Ohio	Adhesive for rubber-to-steel bonding.	Hydrochloric and sulphuric acids.
Vulcanized	Vulcanized Rubber Co., New York, N. Y.	Hard and semi-hard moldings.	

Hercules Makes Resins From Rosin

James A. Lee
Managing Editor, *Chemical Engineering*

ANOTHER inroad into the wood naval stores industry has been made by Hercules Powder Co. with the opening of their plant at Burlington, N. J. The plant produces a brand new resin alcohol, hydroabietyl alcohol; also turns out several groups of resins—Abalyn, Cellolyn, Flexolyns, Lewisols, Pentalyns, Petrex, and ester gums. It is one of the first in this country designed and built especially to make resins. Their longer established plants at Mansfield, Mass., Brunswick, Ga., and Hattiesburg, Miss., also produce synthetic chemicals used in the manufacture of many products.

Improved Plant Practices

Hercules turned to wood naval stores after the first World War. They were branching out into new products to avoid laying off many of their workers. In 1921 they built a plant at Hattiesburg, Miss., for steam distillation of rosin from pine stumps. The same year, purchase of the Yaryan Rosin and Turpentine Co. plants in Georgia and Mississippi made Hercules the world's largest producer of steam distilled turpentine, wood rosin and pine oil.

Hercules chemists and engineers got to work on improving plant practices. They came up with: new refining methods that converted rosin into a product without rosin's tendency to oxidize, discolor and become brittle; new extraction processes that increased yields, improved product quality, and made available other materials not previously obtained from pine wood. Other advances led to development of higher grades of turpentine and pine oil and fractions from them that became the bases for a whole series of new chemicals.

By 1943, the development of new resins from rosin had increased to such an extent that production and sales could be handled only by a full-scale operating department, the Synthetics Department. Four plants, located at Mansfield, Burlington, Brunswick, and Hattiesburg, produce the synthetic chemicals which are used in the manufacture of paint, varnish, lacquer, adhesives, paper, printings, inks, textiles, and many other products.

The plant at Burlington is the newest of the group, having been completed only recently. Plans were based on experience gained at the Hattiesburg plant built several years earlier. This new plant, the largest of the group, is the pride of the department. This was the first time the Synthetics Department had the opportunity to lay out the ideal plant. Incidentally, this department is based entirely on Hercules' own research and development. It is a natural outgrowth from the vast experience gained as the world's largest producer of naval stores.

Pentalyn Resins

The Pentalyn series of resins are based on the raw materials, wood rosin and pentaerythritol. The latter is made at Hercules' Mansfield plant. It is received at Burlington in paper bags. These are elevated to the third floor of the resin kettle building and poured into a small flanged opening in the resin kettle. The molten rosin from the company's naval stores plants is pumped from tank cars through a jacketed aluminum line to storage tanks of the same metal outside the buildings. Aluminum coils in the tanks assist in holding the rosin in liquid state.

Rosin is pumped to the scale tank on the third floor and then to the kettle. Rosin is conveyed and stored in aluminum. All lines and tanks are jacketed to retain heat. Coils in the tanks also assist in holding the rosin in liquid form.

One of the Pentalyn group of resins is a phenolic modified pentaerythritol ester of rosin. Another is a pentaerythritol ester of hydrogenated rosin.

Glycol and glycerine used in making other types of resins and modifications on arrival at the plant in tank cars are pumped to storage tanks near the kettle building and from there to weigh tanks and the kettles.

Maleic anhydride used in making certain of the Lewisol series of resins is received in 50 gal. galvanized drums and rolled into a warming building with steam coils along one wall. Here the temperature of the anhydride is raised above its melting point of 52 deg. C. As required a drum is rolled out at the exit end, opened and the contents pumped with a plain iron pump from the drum through a jacketed stainless steel line to an aluminum weigh tank on the third floor of the kettle building.

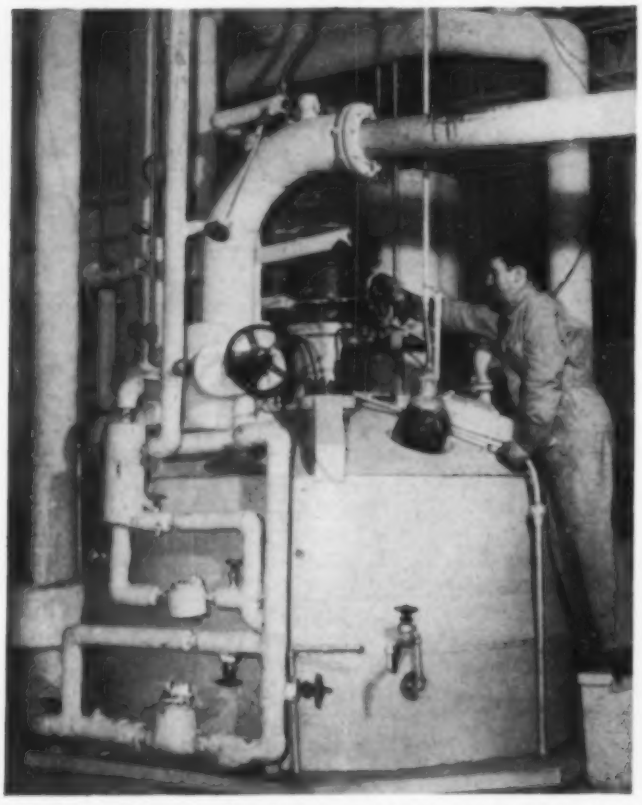
The stainless steel jacketed and lagged vessels are typical resin kettles. All lagging on the kettles is covered with sheet metal to assist in good housekeeping. The kettles are heated by Dowtherm vapor. These kettles are used for a variety of resins, glycerine, pentaerythritol, and glycol resin esters, as well as maleic modification of them.

A copper kettle is used for reacting the phenol and formaldehyde to make an intermediate stage phenolic resin in sirup form used as a modifier in some of the other resins.

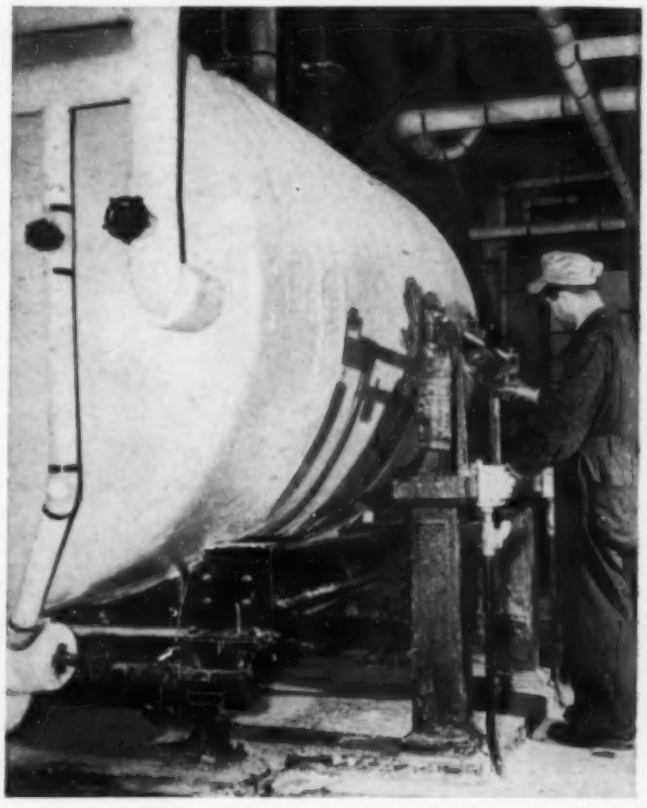
The Petrex resins are based on resinous terpene polybasic acid and an alcohol. These resins are made in aluminum kettles heated by circulating oil. This metal is used to prevent discoloration.

When the reactions in the various resin kettles are complete some of the finished materials pass to large

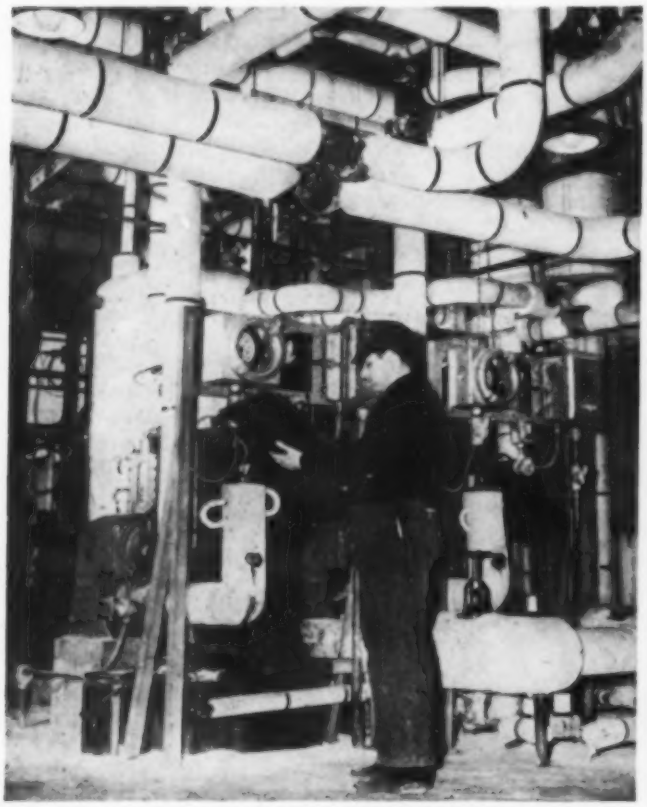
Random shots in Hercules' new plant at Burlington, N. J. In addition to dozens of synthetic resins the plant turns out a brand new chemical, hydroabietyl alcohol.



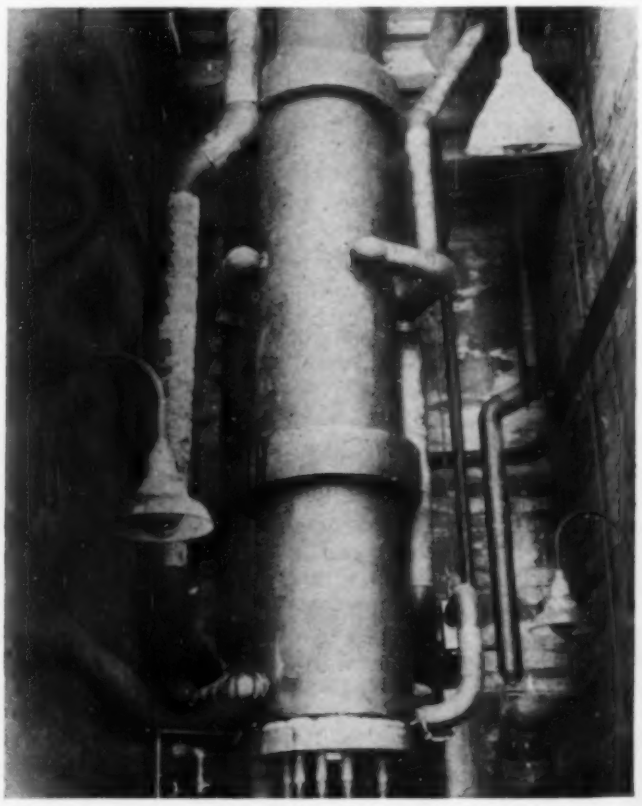
Typical stainless steel rosin kettle which is jacketed in order to insure retention of heat.



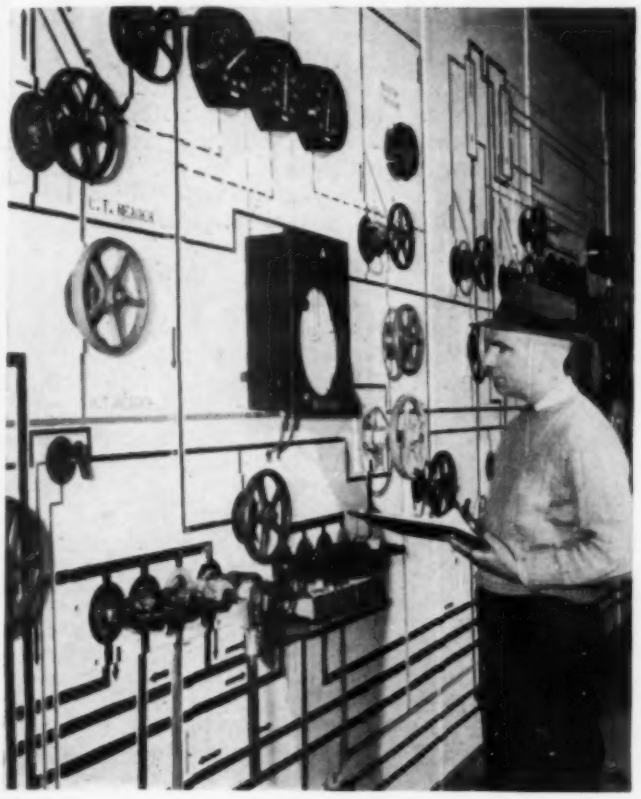
Rosin scale tank in which rosin is weighed before being pumped on to the resin kettles.



Temperature control unit in the Abalyn building where this raw material for hydroabietyl alcohol is made.



Reactor where methyl abietate is reduced to hydroabietyl alcohol under pressure and in contact with a catalyst.



This control panel is perhaps the most eyecatching feature of Hercules' new Burlington plant. From it, an operator can control flow and temperature in the reactors where methyl abietate is converted to hydroabietyl alcohol. Because these reactors operate at high pressure they are inclosed in barricades and every effort is made to remove all necessity for an operator going inside. All valves controlling Dowtherm or product and all instruments indicating temperatures and pressures are located on this board. Valve bodies and connecting piping are located behind the board and all valve stems and wheels extend through holes in the panel board. Also, a piping corridor between the reactor barricade and the panel board provides for expansion and piping repairs during operations without entering the barricaded area.

Because of the multiplicity of valves and instruments a flowsheet of the operation is painted on the face of the panel board to simplify the training of operators. The flowsheet is full size and piping follows as closely as possible the actual location of piping behind the panel board. In the flowsheet, piping which connects into a given valve is drawn to connect to the stem and wheel of the valve extending through the panel board.

Colors are used to distinguish piping carrying product to and from reactors and product in process. Different size lines as well as different colors are used to distinguish service piping such as steam and Dowtherm. Dotted lines of another color are used to indicate connections between thermometers and pressure gages and the point in the piping where they connect. Reactors, preheaters, and other process equipment located in the barricaded area are shown diagrammatically at the top of the panel board immediately above the operating valves and instruments. All lines which are not obvious from the flowsheet are suitably labeled.

Experience has indicated that this type of diagrammatic panel board results in a safer and more accurate control of operations and simplifies the training of new operators. It is particularly applicable to panel boards having a large number of control valves as distinguished from panel boards which are predominately for instruments.

scale tanks. These tanks are equipped with cooling coils. Here the resins are cut with high-flash petroleum fractions, toluene, denatured alcohol or some other solvent depending upon the customers requirements. The resins then go to the drum filling department. Other finished products go directly to the cooling shed for drumming.

The stainless steel resin kettles with provision for operation under vacuum or inert gas, agitation, Dowtherm heating, and pipelines to many raw materials, give almost unlimited flexibility in products that can be processed. This flexibility was demonstrated in the month of March when the four kettles were used for producing 25 different resins. The production of a great variety of resins is necessary to meet customers demands. This is due to the fact that the plant is near the metropolitan New York market where customers expect quick delivery.

All storage tanks throughout the plant are covered with magnesia blocks and Transite sheets. The latter are fastened together by stainless steel ferrules and screws. The covers are sheet iron. This combination of insulating material has proved to be very satisfactory. The Transite covering is well liked since it can be washed free of dirt or after spills very easily.

Hydroabietyl Alcohol

From Hercules' new plant, a new chemical. The process: (1) Rosin plus methanol yields methyl abietate. (2) Methyl abietate plus hydrogen yields hydroabietyl alcohol.

HYDROABIETYL alcohol has been on the market since February when that unit of the Burlington plant began operating (Pictured Flowsheet, p. 158). A base from which a wide variety of products may be derived, indications are that this new resin alcohol may be reacted to yield resins, foamers, detergents, wetting agents, emulsifying agents, plasticizers, corrosion inhibitors, antioxidants, bactericides and compounds highly stable to ultraviolet light. It may be used without further chemical reaction as a modifier for chlorinated rubber, polyamides, hydrogenated oils, textile sizes, rubber compositions, and essential oil vehicles.

Hydroabietyl alcohol is prepared by the hydrogenolysis of Abalyn resin, the methyl ester of rosin, at high pressure. The principal constituent of Abalyn is methyl abietate, the methyl ester of abietic acid.

Abalyn Production

Both the hydrogen and the Abalyn are produced at the Burlington plant and brought together for processing in the alcohol unit. The resin is made in a building devoted entirely to that material. It is made by the action of methanol on rosin at high pressure. Its production will first be considered.

A wood rosin in tank cars arrives at the plant from one of the company's naval stores plants in the South. It is melted by means of steam coils in the car and pumped by jacketed steel pumps to steel storage tanks near the Abalyn building. As required the rosin is next pumped at about 800 psi. to stainless steel (tube) preheaters.

Methanol is received in tank cars and pumped to storage at the tank farm. Later the methanol is pumped to feed tanks near the processing building. And as required it is pumped to preheaters on the second floor of the building. Preheated rosin and methanol come together in a stainless steel reactor. The rosin enters at the top and flows countercurrent to the methanol entering the reactor at the bottom. Conversion of the rosin to the methyl ester of abietic acid takes place at a pressure of about 1,000 psi. The acid number is reduced to 5. This is a function of the contact time allowed in the reactor. A Mason-Neilan automatic valve assures con-

stant pressure. The mass passes to the black iron, crude Abalyn feed pot.

An excess of methanol is used in the reactor. The portion not consumed in the reaction passes to a copper still where it is recovered for return to the system for reuse.

The crude Abalyn is vaporized and passes from the still to a steel separator. After separation, the refined Abalyn goes to a catch tank and from there through a meter to outside storage. The residue from the separator drops down to a catch tank. From this tank it is transferred by Moyno pump to a weigh tank on a scale and from there to storage on the outside of the building.

The resin is a light colored viscous liquid characterized by low vapor pressure and high thermal stability. It is shipped in steel tank cars to customers or piped to the hydroabietyl alcohol building for consumption there. It is also piped to the resin kettle building where it is used in making other resins.

Hydrogen

Hydrogen, the other raw material for the alcohol production, is made from propane in accordance with the Hercules process for cracking hydrocarbons. The hydrocarbon reaches the Burlington plant in tank cars or trucks and is pumped to horizontal, pressure storage tanks in the tank farm. Temperature is maintained in the tanks so as to keep the propane in the vapor phase at about 150 lb. Pressure is reduced by a regulating valve and the propane is fed along with steam through a mixing chamber to the top of the cracking tube. The mixture of propane and steam pass through the catalyst at high temperature resulting in the formation of carbon monoxide and hydrogen. There are also present small amounts of methane, carbon dioxide, and excess steam. These gases pass while still hot to a converter where the monoxide reacts with more steam to form carbon dioxide and more hydrogen.

Products of the reaction of the propane and steam pass through a cooler and then go to a gas holder which serves as a surge tank for it holds a 45-minute supply. From this holder the gas passes to a 3-stage compressor which raises the pressure from atmospheric to 2,500 lb. After the first and second stages the pressure is between 450 and 500 lb. The gas goes to a tower where water is fed countercurrently to remove CO_2. From the water tower the gas passes through weak caustic in order to remove final traces of CO_2. It then goes to the third stage and from there through a methanator located in a concrete barricade. This precaution is necessary because of the high pressure under which it is operated. Here the catalyst high temperature and pressure convert the remaining carbon monoxide together with a small portion of the total hydrogen to form methane and steam. Booster compressors raise the pressure to 5,500 psi.

The alcohol is made from the raw materials, hydrogen and the rosin ester, Abalyn. Both materials are brought to the alcohol building from other parts of the Burlington plant. The Abalyn is easily pumped at 90 deg. F. to feed tanks in the alcohol unit. A float control mercoid switch on the feed tank starts and stops the pump so as to maintain the level. Temperature is maintained constant by a Sylphon regulator valve. From here it passes through an integrating meter to Aldrich pumps which increase the pressure.

An interesting side light on these particular pumps concerns the Dana packing material with which they are equipped. William Dana is at the Hattiesburg plant of Hercules. He developed this packing, which now bears his name, a year or two ago. It is a mechanical packing which works only under pressure. Dana packing has had a remarkable record of a year of continuous service which compares to the former packing which had a life of one shift.

The hydrogen and Abalyn are brought together in a mixing block. The mixture goes to a preheater, a coil with liquid Dowtherm around it. After the temperature of the mixture is raised almost to the reaction point the mixture passes to the Abalyn feed header, a line connecting all reactors. A second preheater, immediately following the first is used for making final adjustments in the temperature. The mixture then enters the bottom of the reactors.

Reactors are tall forged, Type 304 stainless steel vessels. Each one is located in a concrete barricade. The closure on the top and bottom of the reactors is interesting. The seat is on the side of the reactor. The head moves with respect to the retaining flange which forces the copper gasket outward against the reactor walls so that greater pressure means less opportunity for leaks.

Under normal operation two reactors are used in progressive series, A and B, B and C, C and A, and so forth, with the second reactor in each case containing the fresh catalyst. The reactor that is not in operation is being emptied and recharged. The control is done by laboratory analyses which are made hourly in order to determine percent purity of product.

When leaving the second of the two reactors the products pass to a high-pressure separator located in a concrete barricade. Here the excess hydrogen gas is removed through a back-pressure valve which maintains the required high pressure in the system.

From the bottom of the separator the liquid product is blown off through a regulating valve operated from the weight of the high-pressure separator. The gas is purged off into the air. The liquid product, which is saturated with hydrogen and methanol passes to the low-pressure separator maintained at 10-lb. pressure.

The hydrogen and methanol are flashed off leaving the product. From here the hydroabietyl alcohol goes to the cooler and then through the Full-flow filter. The product is then stored or put into drums.

The abalyn feed lines in this department prior to the Aldrich pumps are black iron. From this point through the low-pressure separator the pipe is stainless steel and from there on all equipment is made of aluminum to prevent discoloration or contamination of product.

The Dowtherm system consists of a one-million Btu. boiler which is oil fired. Vapors from this boiler heat the second Dowtherm in a closed liquid system. A header on the second system furnishes high-temperature Dowtherm liquid to jackets of reactors and preheaters. Part of the Dowtherm is cooled by water to furnish a low-temperature Dowtherm header which can be used on the jackets of reactors and preheaters for cooling.

There are three Dowtherm boilers in the Burlington plant. The three are installed out of doors following the present-day general trend in the installation of equipment. This policy has been economical since a separate building would have been necessary for each boiler due to need for safety.

Emphasis in this article is on hydroabietyl alcohol as it is a new chemical offering interesting possibilities to a large number of chemists and engineers in the other process industries. However, as was mentioned earlier, Hercules also makes a variety of resins at the Burlington, N. J., plant.

The writer wishes to express appreciation to Mr. C. A. Bunce, plant manager; Mr. Harold Platt, chief engineer, Mr. Homer Smith and Mr. Parkinson, for many courtesies shown him on the occasion of his visits to the Burlington plant of Hercules Powder Co.

Chromatography at work. Merck & Co.'s chromatographic adsorption columns, used to purify streptomycin.

Chromatography

Roger Williams, Jr. and J. V. Hightower
Respectively, Assistant Editor and Southwest Editor, *Chemical Engineering*

Two *"Chem & Met"* editors size up the industry's newest unit operation—its principles, practice and potential.

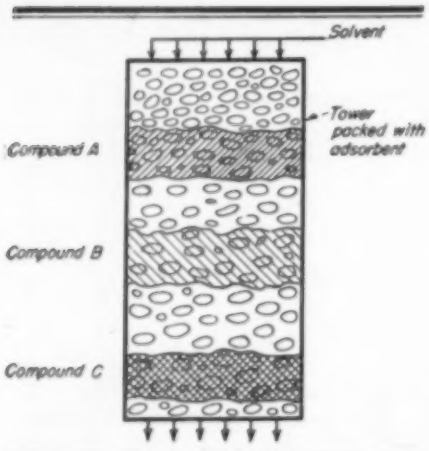
ONCE in a while a really new unit operation comes into commercial use, and when it does everyone starts working feverishly on it at the same time. No one wants to be left behind on the new processes that may come from the use of the new unit operation. Such was the case a few years ago when fluidized solids first came to the commercial scene. Such is now the case with selective adsorption and desorption as a means of separating liquids of closely related chemical properties.

Core of the new development is chromatography, developed back in 1906 by Michael Tswett. Chromatography was dormant until 1931 when it began to emerge as a valuable laboratory tool. Today, however, the unit operation has gone beyond Tswett's limited work. It might be more properly defined as: separation of liquids by differences in their adsorption coefficients.

Today chromatography is a valuable laboratory tool. One of the big problems faced in much organic research, particularly biochemical work, has been the separation and identification of mixtures of closely related chemicals. This has been particularly true of vitamins and amino acids. Regular distillation could not be used because the materials would break down under the heating required to vaporize them. Even molecular distillation sometimes failed since the differences in relative volatility of closely related chemicals are often slight. Multiple recrystallization often worked but was a tedious procedure. Chromatography filled the bill.

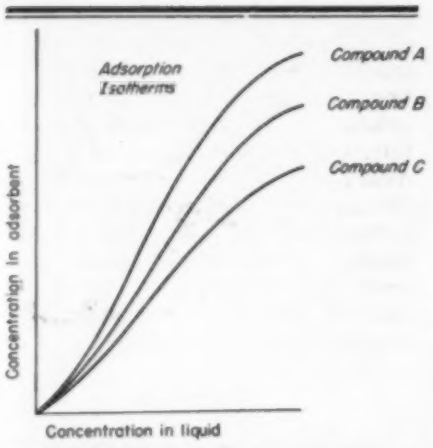
Now chromatography has taken the step from a laboratory tool to a commercially economic unit operation. Two of the earliest commercial applications will be described in detail below. They are the plants of Valley Vitamins, Inc., at McAllen, Tex., producing plant pigments from alfalfa, and the purification of streptomycin by Merck & Co. at Elkton, Va.

First, how does chromatography work?



Separating *A*, *B* and *C*

Previous to the moment represented by the drawing, a solution containing *A*, *B* and *C* was passed into the top of the column and all three materials were adsorbed in a single band near the top. For some time now pure solvent has been passed continuously down through the column. Gradually the solvent, by desorption from the band and readsorption further down, has moved the three materials down the column. But they've descended at different rates. This rate differential is enough to make the three materials separate into three distinct bands, as shown. The desired end, separation of *A*, *B* and *C*, is therefore accomplished simply by collecting separately each of them as it emerges in solution from the bottom of the tower. The reason one compound descends faster than another is that the adsorbent holds each with a different degree of tenacity—or to use the experts' language . . .



. . . Each of the compounds *A*, *B* and *C* has a slightly different adsorption isotherm. (The isotherm shows the concentration of the chemical on the adsorbent which is in equilibrium with a given concentration of the same chemical in the liquid phase.) For a given adsorbent and a given solvent, all materials have different isotherms. The theorists use these isotherms, and the differences between them, as the basis for their mathematical studies of chromatography. Without going into the mathematics, the significance of the isotherm can be sensed intuitively: Note that the curve for *C* is to the right of the other two; thus, to get equal amounts of *A*, *B* and *C* adsorbed, *C* must be in higher concentration in solution. Evidently the adsorbent has less affinity for *C* and holds it with less tenacity—which was the reason given in the first place for *C*'s moving more readily and more speedily down the adsorbent column.

Principles—How Chromatography Works

THE phenomenon of adsorption is nothing new to chemical engineers. For years adsorption has been used to recover solvents from waste air streams and similar removal of valuable chemicals from gases. Solid adsorbents have also long been used to remove impurities and coloring matter from non-adsorbable liquids. The thing that chromatography does is to separate two or more chemicals both of which have been adsorbed.

For any given solid adsorbent, a given chemical to be adsorbed, and a given solvent carrier, there is one unique adsorption isotherm. Put another way, an equilibrium exists of the form

$$q/m = f(c)$$

where q is the number of moles adsorbed, m is the weight of adsorbent, and c is the concentration of the chemical in the solvent. Most isotherms are the same shape as the illustration.

The separation ability of chromatography stems from the fact that even closely related chemicals have different adsorption isotherms in the same solvent-solid system.

First put an adsorbent into the form of a column, by enclosing it in a tube or tower, and then pass a small amount of solution containing an adsorbable chemical through the column. The chemical to be adsorbed does so in the form of a saturated band near the top of the column. Now if pure solvent is passed down the column, the band of adsorbed material will move down the column, retaining its band form. Loss of sharpness of the band as it moves down is surprisingly slight. Finally the band will reach the bottom of the column and emerge. The solution containing the band chemical can be kept separate and the chemical recovered.

The speed of such a downward movement of an adsorbed band of material is dependent on the equilibrium mentioned above. In other words, it is dependent on the tenacity with which the solid adsorbes that particular chemical. Therefore, if two chemicals with different adsorption coefficients are passed simultaneously through the same column, the bands of the two chemicals will move at different speeds and will tend to separate. If the column is tall enough, the bands will completely separate and the two chemicals which were mixed when applied to the column may be recovered separately.

The efficiency of such separations is remarkable. In separating rare earth elements by this method Boyd[1] found: "By the utilization of 300 mesh particles and temperatures of 100 deg. C., it has been possible to operate exchange columns possessing as many as 1,500 theoretical plates per meter length, or, with an HETP of less than one millimeter. It is therefore not surprising that it has been possible not only to separate the rare earths, but to resolve some of them to an extent such that they have contained less than one part per million of either adjacent rare earth neighbor."

The theory of chromatography is little understood. Mathematical treatments have been attempted with some success, but when several chemicals are to be separated the math involved becomes highly complicated. Wilson developed the first mathematical treatment[2] that successfully correlates with experiment for a single adsorbed chemical.

Taking a column of adsorbent, saturated with pure solvent, the mixed solution poured through the column will first give a band of adsorbed material. Theoretically this band will have sharp edges and within the band the concentration of solute in the solvent will be the same throughout its length. This assumes two things: that instantaneous equilibrium is achieved and that the effects of diffusion are nil. Mathematically the width of the band can be expressed by

$$\frac{vc_1}{\alpha c_1 - Mf(c_1)}$$

where v is the volume of solution in the band area, c_1 is the concentration of solute in the solution in the band area, α is the fraction voids in the packed adsorbent per unit length, and M is the weight of adsorbent in the band area per unit length.

Now if additional pure solvent is poured through the column, the band of adsorbed material will slowly move down the column. Expressed as length of movement per unit volume of solvent added to the column, the downward migration of the band is given by Wilson as

$$\frac{c_1}{\alpha c_1 - Mf(c_1)}$$

But assuming instantaneous equili-

brium, Wilson warns that mathematically "the band should remain sharp during the process of development and . . . its width should remain constant as it moves down the column. Experimentally these conclusions are found to hold only approximately."

Hence, although holding only approximately, the mathematics of single chemical adsorption seem to have been fairly well worked out. More recent work has indicated that the above derivation is valid only when $q/m = kc$. The extension of this treatment to the adsorption, simultaneously, of several chemicals would be easy if each chemical operated independently. In other words, it would be simple if the adsorption isotherms in a mixed system acted the same as the individual isotherms. The trouble is that the isotherms are not independent. Hence the mathematics gets into very complicated partial differentials. Assuming that the adsorption isotherms work independently, it can be and has been worked out.

Wilson says of the solution: "It remains to discuss the possibility of using the present theory to predict on the basis of known sorption isotherms whether or not a given adsorbent may be used for the chromatographic separation of a given set of solutes. In view of the approximations involved in the neglect of diffusion and of rates of adsorption and desorption, it is evident that only an approximate prediction can be made; the complete application of the theory requires moreover a knowledge of the dependence of the sorption isotherms on the concentrations of all solutes present. In most cases it is more difficult and tedious to acquire this knowledge than to determine empirically which adsorbents are useful for the separation."

De Vault[3] sums up the mathematical treatment by pointing out "that no guarantee has been given that queer things will not happen under a wide variety of conditions not discussed here."

Hence the theoretical treatment of chromatography may be summed up by saying that although mathematical treatments do exist they are seldom used; an empirical approach is more general.

Possible Uses

The possible uses for chromatography are legion. In a general way Zechmeister and Cholnoky[4] grouped them as follows: "(a) Testing the homogeneity of a substance. (b) Establishing the identity or non-identity of two substances. (c) Concentration of a product occurring in natural sources at great dilutions. (d) Separation, identification, estimation and isolation of the constituents of a mixture. (e) Purification, e.g. of a technical product, from contaminants. (f) Identification and control of commercial products." Separation and purification are the fields where most work has been going on in the past and will continue in the future, from a commercial standpoint.

Adsorbents

The adsorbents used are also legion. Commercially the leading contenders are activated carbon, alumina and silica gel. Others which have been used in laboratories include powdered sucrose, inulin, aluminum oxide-hydrate, magnesium oxide, calcium hydroxide, calcium sulphate, calcium carbonate, soda ash, Floridin, Fuller's earth, and the zeolites.

Choice of the proper adsorbent for a particular job is a problem. In normal adsorption operations the desire is to find the most highly active adsorbent for the chemical involved. This is of course tempered by the fact that if recovery is required it must be possible to desorb the material. In adsorption separation, only a mildly active adsorbent is wanted. If the adsorbent is too active, the bands of material will not move down the column fast enough for the process to be economic. On the other hand, the bands cannot move too fast or satisfactory separation will not be achieved. Hence the adsorbent chosen is likely to be a compromise. As one expert puts it, "One individual with a 'green thumb' is worth ten books on theory."

One new set of adsorbents has to be watched. So far the only adsorbents considered have adsorbed chemicals physically. The new ion exchange resins do their adsorbing, if you can call it that, by chemical means. But in many cases, particularly in amino acid separations, the ion exchange resins exhibit the same chromatographic separability that the physical adsorbents do. Moreover, since the ion exchange resins are synthetically made, there is the possibility that resins can be tailor-made for an individual job. When such resins are used they are generally thought of as a capital investment, not as a continuing operating expense. Hence, a company can afford to buy a special resin, despite its high cost, in the same way that it buys a specially designed pump or still. For some things the physical adsorbents do the job well, but the ion exchange resins will become a big factor in the chromatographic field.

Column Design

The design of chromatographic columns, for the usual batch operation, involves several considerations. The final design is usually a compromise between sets of opposing factors. The natural desire is to have a column with as high capacity as possible. However, any bed of solids has a high pressure drop, and the greater the flow rate the higher and more costly the feed pressure required. Furthermore, high flow rates tend to lead to channelling and high diffusion, both of which spread the separate chemical bands and cut down on the efficiency of separation. Another requirement is even feed liquid distribution.

In general the design variables are flow rate, particle size, column diameter, and column height. Because, as mentioned above, laboratory determination rather than mathematical investigation is required, an extensive semi-works investigation is often needed. Maximum flow rate can generally be set by that rate at which channelling or band diffusion appear. Column diameter is usually limited to some maximum beyond which satisfactory liquid distribution cannot be maintained. Column height will be set experimentally and is limited by the height that is necessary to get the necessary separation, the taller the column the better the separation. Within these limits there is a wide area of design choice, with the final decision being economic. In general, separations will be characterized by lower capacities and higher selectivities than in conventional separation methods such as distillation.

The main calculatable factor is pressure drop. Although the original work involved did not deal with the small sized particles used in chromatography, correlations such as those of Colburn and Chilton[5] and of Meyer and Work[6] can be used to predict pressure drop providing the bed configuration (percent voids) is known.

The adsorption columns used by Valley Vitamins, Inc., whose operation will be described below, are 26 in. in diameter and are 7 ft. tall. Adsorbent support consists of first a steel plate with ½-in. holes drilled on ⅞th in. centers, then a 100 mesh stainless or Monel screen, and finally a ¼ in. galvanized screen.

Columns used by Merck have been as large as 36 in. diameter by 12 ft. of packed height. Bed support for these columns consists of a sieve plate and a

layer of fine mesh wire cloth. Pressure drop through these columns is 60 psig.

•

PERHAPS the best way to explain the methods of operating chromatographic columns is to give examples of commercial operations today. At McAllen, Tex., Valley Vitamins, Inc., is producing beta-carotene, xanthophyll, and chlorophyll from alfalfa. In brief, ground alfalfa is first extracted with hexane and then the three plant pigments are separated by chromatography. The resulting separate solutions of the chemicals in their solvents are concentrated and the products recovered for sale.

Vitamin Production

Six adsorption towers are in this service. Normal practice is to operate the towers in pairs, each pair being charged in parallel. At a given time, one pair is being charged with the crude mixture resulting from the hexane extraction of the alfalfa meal, another pair is eluting xanthophyll and the third pair is eluting chlorophyll. The following is a description of a complete cycle beginning with the charging of concentrated crude extract:

1. Two towers containing carbon black are charged at the bottom with fresh hexane. When hexane begins flowing through the sight glasses at the tops of the towers, the towers are full. Hexane charge rate is about 3 gpm. to each tower. More rapid charging would tend to cause channeling of the carbon black or result in entrainment.

2. Concentrated crude extract is now charged into the bottoms of the towers at about 1 gpm. Discharge from the towers is at this stage going to storage for wash hexane. Operation continues until lipoids (fatty substances) appear in the discharge, which occurs after approximately 126-155 min. The presence of lipoids is detected manually by the greasy character of a sample of discharge taken from sample cocks.

3. With crude extract still being pumped, the towers are discharged to lipoid storage until the presence of carotene in the discharge is noted by yellow color appearing in the sight glasses of the discharge lines. The pumping of extract is now stopped.

4. Fresh hexane is now pumped into the bottoms of towers at about 1 gpm. and the towers are discharged to carotene extract storage. Pumping of hexane continues for about 110 min.

Valley Vitamins, Inc., uses chromatographic adsorption columns (photo and diagram above) to separate carotene, xanthophyll and chlorophyll from alfalfa extract.

Practice—How Chromatography Has Been

or until such time as the yellow color of the discharge begins fading appreciably, indicating that most of the carotene has been removed and that xanthophyll is nearing the tops of the towers.

5. At this stage, with hexane still entering, the towers are discharged to storage for wash hexane until the yellow color (carotene) has faded from the sight glasses, indicating that carotene has been removed.

6. The towers are now allowed to drain to wash hexane storage in order to avoid contamination by hexane of the hexane-isopropanol solvent used for elution of xanthophyll, the next product to be removed.

7. Weak xanthophyll eluate (a small amount of xanthophyll contained in hexane-isopropanol from a previous adsorption) is now pumped into the bottoms of the towers at about 2 gpm. At the same time the towers are discharging into weak xanthophyll eluate storage. This is a recirculation operation designed to move the xanthophyll bands to the tops of the towers. Operation continues until the light yellow color in the sight glasses darkens, showing that the xanthophyll has begun to emerge. This occurs about an hour after the towers begin to discharge.

8. At this point the towers are discharged to storage for concentrated xanthophyll eluate until the yellow color fades (about 4 hr.), indicating that the xanthophyll band has been substantially removed.

9. Hexane-isopropanol solvent is now pumped into bottoms of towers. Discharge goes to storage for weak xanthophyll eluate until no yellow shows in the sight glasses, indicating removal of the remaining xanthophyll.

10. The towers are now drained to storage for weak xanthophyll eluate.

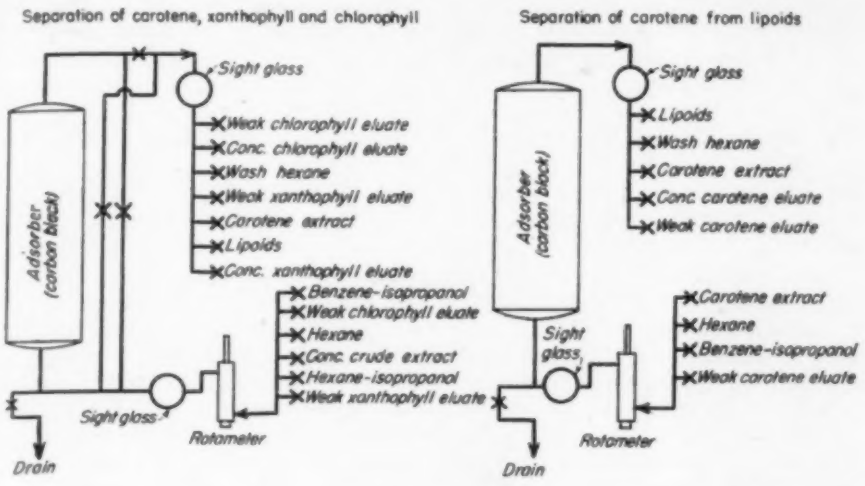
11. Weak chlorophyll eluate (a small amount of chlorophyll contained in benzene-isopropanol from a previous adsorption) is now pumped into the towers at the top. Direction of the feed is reversed because the chlorophyll bands are still closer to the bottoms than the tops of the towers. Towers are discharged to storage for concentrated chlorophyll eluate until color in bottom sight glasses changes from dark to light green. This occurs in about 8 hr. and indicates that substantially all chlorophyll has been washed out.

12. Fresh benzene-isopropanol solvent is now pumped into tops of towers. Discharge goes to storage for weak chlorophyll eluate. After about 8 hr. color of discharge in bottom sight glasses has disappeared, indicating final removal of cholorophyll.

13. Towers are then drained, the drainage going to weak cholorphyll eluate storage. This completes the cycle.

Carotene Purification

The carotene extracted with hexane during the adsorptive separation of carotene, xanthophyll and chlorophyll is contaminated with an appreciable amount of lipoids and is sub-



Difficult separations like this are chromatography's meat. Fields posing such separations are petroleum refining, biochemistry and petrochemicals.

Put to Work on a Commercial Scale

jected to a second adsorption step for removal of the lipoids. Four towers, unrelated to the six used for the treatment of the original crude extract, are used in this service. Of the four, at a given time two are being charged with the carotene extract in parallel flow and the other two are eluting carotene. The following is a description of the cycle involved in the carotene-lipoids separation:

1. Fresh hexane is pumped into the bottoms of two towers at about 3 gpm. to each tower. Pumping is continued until the towers are filled, at which point hexane begins flowing through sight glasses at the tops of the towers.

2. At this point hexane pumping is stopped and the pumping of carotene extract at a rate of about 3 gpm. begins. Discharge from the towers is sent to storage for wash hexane until lipoids appear as shown by greasy character of the discharging fluid taken from a sample cock.

3. With carotene extract at a rate of 2 gpm. still being pumped, the towers are now discharged to lipoid storage until a yellow color appears in the sight glasses, indicating that the carotene has moved up the towers and has begun to emerge.

4. The pumping of carotene extract ceases. Weak carotene eluate (small amount of carotene in benzene-isopropanol from a prior cycle) is now pumped to the towers at about 2 gpm. Towers are discharged to storage for carotene extract for 45 min. At this point the adsorbed carotene has begun to emerge from the towers.

5. Weak carotene eluate continues to be pumped to the towers, but the towers are now discharged to storage for concentrated carotene eluate until the yellow color fades from the discharge, indicating removal of carotene. Pumping of weak eluate is stopped.

6. Benzene-isopropanol solvent is now pumped into towers at 2.5 gpm. Towers discharge to storage for weak carotene eluate until no yellow color shows in discharge sight glass.

7. Pumping of benzene-isopropanol is stopped. Hexane is now pumped to towers at 1 gpm. Towers discharge to weak carotene eluate for 90 min. This completes the cycle.

Streptomycin

Another commercial chromatography user is Merck & Co., at Elkton, Va. Merck uses chromatographic adsorption on alumina to produce highly active streptomycin. The process is somewhat different from that of Valley Vitamins since there is no clean-cut distinction between a few chemicals. As Peck[7] puts it: "The problem was the separation of a complex active substance which was soluble in water and in methanol, but nearly insoluble in the common organic solvents, from large amounts of inactive impurities possessing very similar solubility properties. Chromatography appeared to be the only practicable approach, since neither purification by extraction from water into organic solvents and back into water, nor direct crystallization of the active substance was possible."

Actually the chromatographic purification of streptomycin involves cutting a segment of active material from a very complex mixture of chemicals. The complexity may be indicated by pointing out that many of the individual chemicals involved have never been identified.

When a solution of crude streptomycin in methanol is passed through an alumina column, and then eluted with pure methanol, the activity of the effluent solution rises rapidly from zero to a peak and then tails off slowly. The problem of yield is this case is, therefore, economic. A large quantity of material can be recovered at a high yield but with low average activity, or a small quantity can be produced at a low yield but with very high activity. Yieldwise, the Merck commercial operation is a compromise consistent with succeeding purification steps.

Feed to the Merck units is a solution of streptomycin hydrochloride dissolved in methanol. This solution is pumped at 60 psig. pressure into the top of the column, which is filled with 100-200 mesh alumina. At the end of a given amount of feed solution, pumping is stopped and the column is fed pure methanol to elute the crude streptomycin adsorbed at the top of the column.

Effluent from the column is now tested chemically by spot analyses and when active material appears the effluent is sent to a receiver located directly under the adsorption column. The receiver is located adjacent to the column because the product is of such high value that losses due to holdup in the piping cannot be tolerated. Spot chemical analysis is permissible, despite the time it takes, because the entire cycle takes about 24 hr.

Effluent continues to be sent to the product receiver until the activity of the effluent, as indicated by chemical tests, drops to a given level. The remaining adsorbed material is then eluted and recycled to an earlier step in the streptomycin production process. The column is then revivified with distilled water and another run is started.

One interesting operating problem came up when these units were first run. The head pressure on the columns was 60 psig. and the product from the bottom of the units was atmospheric. Initially the top liquid level was controlled by nitrogen pressure, the level being below the top of the column. This resulted in trouble because nitrogen dissolved in the solution at the top of the column and came out of solution at the lower pressures farther down the column. This resulted in

channeling and faulty column operation. The problem was solved by maintaining the column full of liquid at all times.

Other Applications

How many chromatographic separations are in operation on commercial scale in the United States is an open question. The unit operation is so new commercially that few companies are willing to admit its use to their competitors.

The future of chromatography is perhaps the most interesting thing to speculate on. At present two major fields of the process industry are actively working with it. The first is the biochemical field, and the second is the petroleum refining field.

Biological chemistry, vitamins, amino acids, antibiotics, is full of cases where very complex mixtures of organic chemicals are encountered. Separation of the valuable from the valueless has long been a major problem. Chromatography fills the bill. Furthermore, the quantities involved are small and of high unit value. Hence it is possible to use processes that on the face of them look expensive. That is why such unit operations as liquid-liquid extraction and chromatography have had increasing applications in the biochemical field.

It is a known fact that most of the biochemical companies are working hard on chromatography. As a matter of fact a lot of their work is overlapping, sometimes pure duplication. Yet the secrecy that surrounds this work is hard to break. Merck is probably first in the field with more commercial applications than the purification of streptomycin. Others known to be working with chromatography include Schenley, Eli Lilly, and Sharp & Dohme. Still others are probably using the technique. How many of these companies have actual commercial applications is unknown, but it is a sure bet that the commercial use of chromatography will grow in the biochemical field.

Petroleum Field

The biggest opening for chromatography is in petroleum refining. If it comes through, the columns used in this industry would dwarf those in biochemistry. But here again a pall of secrecy shrouds the current research work. The big thing to watch for is the development of continuous chromatography, in equipment probably somewhat analogous to the Hypersorber. As in any type of continuous process, the number of product cuts desired would fix the number of continuous adsorbent draw-offs required. Research work has already arrived at the semi-works stage.

Where will chromatography fit in the petroleum field? Two places are indicated. The first is in the upgrading of lubricating oil fractions by removal of aromatic constituents. The second is in the production of pure organic chemicals from natural, cracked and hydroformed crudes.

Considering first the treatment of lube oil fractions, the recent patent literature indicates the direction of progress. Hirschler and Lipkin, in a recent patent[8] assigned to the Sun Oil Co., state: "The invention has particular utility in the preparation of substantially aromatic-free oils such as the so-called 'white oils' or in the production of moderately refined oils having reduced aromatic content, for example, electrical oils and motor oils. The invention also is useful *in the preparation of highly aromatic products of high molecular weight.*" (Italics supplied.) The invention referred to is a method of selective adsorption on silica gel with removal of the adsorbed aromatics by a two-step desorption. The chromatographic part of the process comes from the fact that several zones are used in series and are desorbed independently. The inventors comment: "Of the aromatic hydrocarbons adsorbed from the charge stock, the most highly aromatic (i. e., those containing the largest proportion of aromatic rings per molecule) are retained in the first section, those retained in the second section are less aromatic, those in the third section are of still lower aromaticity, etc. Separate regeneration of each section thus permits the production of fractions of different aromaticities." Here, then, is a method of doing two things at the same time: (1) Obtaining a paraffin-based lubricating oil from a naphthenic-based crude, and (2) getting as a byproduct a series of different aromatic fractions. The latter's value may be in the further chromatographic separation of the fractions for the recovery of pure chemicals.

Petrochemicals

It is no secret that the petroleum companies have been moving more and more into the organic chemical field. Yet most of the moves so far have been based on relatively simple organic compounds, e. g., ethanol from ethylene via propane and ethane cracking. Shell's range of products based on allyl chloride starting with propylene. The probable reason for this low-molecular-weight beginning is that the starting products can readily be separated in essentially pure form. That has not been true of higher molecular weight hydrocarbons.

Benzene is an example of the type of chemical that can come in large quantities from petroleum sources. In fact it has been stated many times that when and if the price of benzene reaches the neighborhood of 27-30 c. per gal., it will begin flowing to market from refineries. The reason for the high price is the terrific separation problem involved in getting commercially pure benzene out of the conglomerate mixture that a hydroformed stock is. But that is exactly what chromatography can do. Its high selectivity makes it a natural for such a separation if the price can be brought down. That looks like a typical reason why the petroleum companies are working so hard on chromatography.

All in all it must be admitted that chromatography is still new. Its form and features will change radically as it moves into large-scale commercial use. But it is equally obvious that chromatography is a coming unit operation. Chemical engineers will watch its growth with real interest.

Acknowledgment

The authors gratefully acknowledge the assistance of J. C. Winters, Resinous Products and Chemical Co.; H. E. Silcox and C. C. Hardy, Merck & Co.; L. M. Salmon, Valley Vitamins, Inc.; D. D. Cochrane, and C. A. Stokes, Godfrey L. Cabot, Inc.; G. P. Monet, Du Pont Co.; B. M. Bein, Shell Development Co.; and W. B. Fortune, Eli Lilly and Co.

References

[1] Boyd, G. E., speech at New York, N. Y., Sept. 17, 1947.
[2] Wilson, J. N., "A Theory of Chromatography," *J. A. C. S.*, pp. 1583-91, 1940.
[3] De Vault, D., "The Theory of Chromatography," *J. A. C. S.*, pp. 532-540, 1943.
[4] Zechmeister, L., and Cholnoky, L., "Principles and Practice of Chromatography," J. Wiley & Sons, New York, 1944.
[5] Perry, J. H., "Chemical Engineers' Handbook," McGraw-Hill Book Co., New York, 1941, pp. 829-30.
[6] Meyer, W. G., and Work, L. T., "Flow of Fluids Through Beds of Packed Solids," *Trans. A. I. Ch. E.*, pp. 13-33, 1937.
[7] Peck, R. L., "Chromatography in the Streptomychin Problem," *Annals N. Y. Acad. Sciences*, pp. 235-248, Feb. 10, 1948.
[8] U. S. Patent 2,441,572.

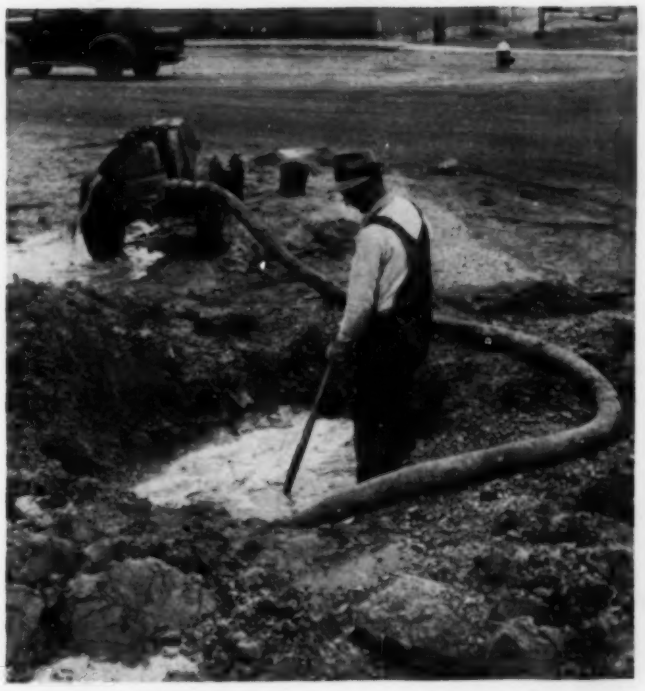
Bibliography

Claesson, S., "Studies on Adsorption and Adsorption Analysis With Special Reference to Homologous Series," Arkiv för Kemi, Mineralogi och Geologi, Band 23, Häfte 1, Stockholm, Sweden (in English).

Zechmeister, L., and Cholnoky, L., "Principles and Practice of Chromatography," John Wiley & Sons, New York, 1944 (in English).

Strain, H. H., "Chromatographic Adsorption Analysis," Interscience Publ. Co., New York, 1942.

1. Another Leak. Puddle trouble marks beginning of a typical case in Dow's test of cathodic protection.



2. First, Excavation. In 1943, before they started cathodic protection, Dow had 145 of these jobs at Midland.

Underground Leaks versus Cathodic Protection

With the case history of its own Midland plant, Dow documents its claims for cathodic protection. They figure a $12,400 investment has saved $6,500 per year.

Arthur Smith, Jr.
Manager Cathodic Protection Sales
Dow Chemical Co., Midland, Mich.

THE Dow Chemical Co. practices as well as preaches its recommendations on the use of magnesium for the cathodic protection of underground pipelines. This article gives the result of Dow's experience in its own plant at Midland, Mich.

Research began on prevention of corrosion by cathodic protection of underground structures about ten years ago. By 1943 it had progressed to the point where a difficult test case was needed. The necessary knotty corrosion problems were available in the 79 miles of underground piping in Dow's own plant. Consequently, research men approached the company's pipe shop and requested the installation of magnesium anodes near all leaks on underground steel or galvanized piping and reports on such installations.

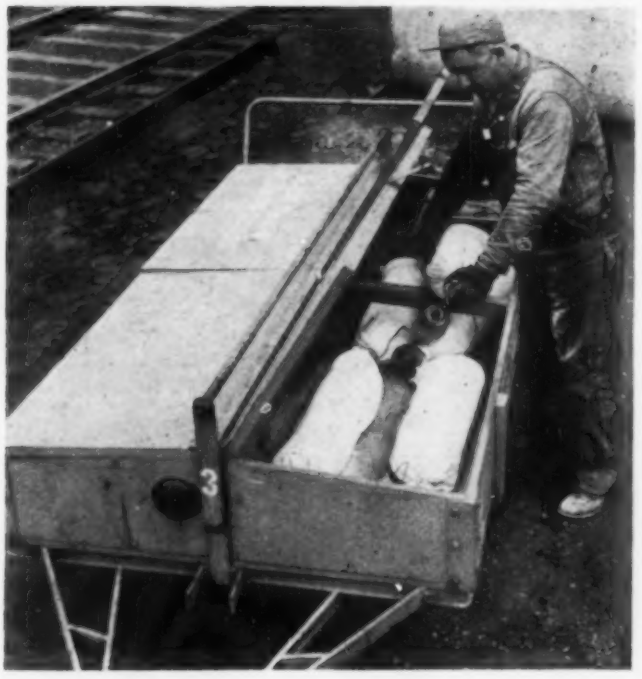
Even with wartime conditions and the pipe shop's major concern with keeping lines open for wartime production, some cathodic protection got under way immediately. But the supervised program of planned protection did not really hit its stride until late in 1944.

Since that time, magnesium anodes have been installed on all new lines as they are laid and at all leak points in any steel or galvanized underground line. The anode current output is unusually high in the vicinity of leaks, so that leak sites are exceptionally favorable places for introducing current into the ground and for getting optimum performance from the anode.

Gradually during 1945, it became apparent that cathodic protection with magnesium was reducing underground line maintenance problems, and drastic reduction in leaks for 1946 and 1947 over the preprotection year of 1943 provided substantiating facts. As of Dec. 1, 1947, about 619 anodes (10,000 lb. of magnesium) had been installed on pipelines in the Midland plant in a little over three years. The leak rate had been reduced from 145 leaks in 1943 to only 45 in 1946 and 54 in 1947. The cost of installing these anodes was in the neighborhood of $12,400, an investment which saved about $6,500 each year in repair costs alone, not to mention savings resulting from reduced plant shut down time due to leaks and lessened losses and contamination of the product in the lines.

Installing anodes at leak sites as-

3. Leak is Uncovered. By 1947 Dow had installed 619 anodes at leak sites; leak rate dropped to a third.



4. Preventive Medicine Arrives. Each bag is a magnesium anode encased in special fast-wetting backfill.

sumes that the corrosion which caused the leak was of a galvanic nature and that each leak probably indicates the presence of an anodic area on the buried pipe. Where this is true, placing a few anodes at the site of each leak repair prevents the numerous leaks which would probably occur in the immediate area in the future, but it fails to prevent leaks from occurring at other anodic areas some distance down the line.

How successful such cathodic protection is depends on the number of anodic areas in the line and how fast the metal in each area corrodes. If anodic areas are limited in number and the corrosion rate at each area is about the same, most of the anodic pipe will be found in a short time and good corrosion control obtained and easily maintained. If, however, the anodic areas are numerous and have variable corrosion rates, as is customary in a large pipe network, satisfactory control of leak frequency takes longer to obtain.

Past experience on large underground pipe systems has shown that leak frequency increases exponentially with time. Frequently the rate of leak occurrence has been found to be proportional to the square of the time elapsed in years after the first leak on the system, unless corrective measures are taken.

On this basis, the results in leak reduction at Midland from 1943 to 1947 are even more impressive. On a plant-wide basis, considering both old and new lines, it is estimated that the leak rate might well have doubled in the four-year period had no protection been applied. If this were the case, the installation of anodes at leaks would have been justified even if it had simply kept the 1943 leak rate from going higher.

Test Site

Various companies have had gratifying leak reductions following installation of magnesium anodes at leak sites. The Houston Pipe Line Co., for example, has a three-mile section of bare 4-in. pipe where they were having 80 leaks per year. They used this stretch as a test site. One 16-lb. magnesium anode was connected to the pipe at each leak repaired and no coating was applied to the pipe. This practice was started in October 1945 and in June 1947 there had not been a leak in this section in seven months. The reason for this type of application is to get some protection at the places where it is most needed as rapidly as possible.

The major disadvantage of anode installations only at leak repair sites, especially on large pipe networks, is that the practice allows the leaks to "set the pace" until a sufficient number of anodes have been placed to slow down corrosion everywhere on the underground pipe network.

Nonetheless, the results achieved even with the anodes installed only at the site of leak repairs have been outstanding. One example of how efficiently magnesium anodes operate was shown when they were installed along two hot brine pipelines, each about 900 ft. long. Both lines were considered obsolete as long ago as 1944, and plans were made to replace them immediately. At the request of the research laboratory, both were left in service and protected with 184 anodes. Leak records showed immediate improvement, despite the fact that anode installations were constantly being disturbed by construction and road maintenance crews.

These lines showed, too, that the number of leaks on the protected lines was in direct proportion to the grading and excavating being done in the area. When circuits were not disturbed, the leaks were few and far between. With much ground disturbance in the area, the pipes suffered because the protective current was cut off when wires were broken or detached. The practice of cathodic protection in a chemical plant is considerably more complicated than on cross-country lines in that areas are more congested with pipelines, and excavation and grading operations are continually disturbing the installations of both pipe and anodes. This experience has taught the need for designing installations which would be relatively immune to disturbance by general maintenance and new construction.

Nevertheless, cathodic protection with magnesium anodes added two to

5. Nearly Finished. Leak has been clamped shut. Repairman is thermit welding anode lead wire to pipe.

6. Ready to Backfill. Pipe is now protected galvanically. Magnesium will corrode in preference to steel.

three years to the life of these lines and enabled them to operate during the difficult war period of critical labor and material shortages.

In another instance, a 26-in. and a 4-in. line ran parallel to each other. Between the date of their installation in 1937 and installation of magnesium anodes in 1945, six leaks had occurred on the smaller pipe, and none on the larger, indicating that the 4-in. pipe might be acting as an anode to the larger one. In 1945 the lines were bonded together and 93 protective anodes installed. Since this time, there have been no leaks in either pipeline.

Three-Way Program

Because the existing program proved such a success, a new, three-objective program has been planned and is scheduled to get under way in the Midland plant soon.

The three-way program consists of completely protecting one zone in the plant where the most leaks occur, of giving all new pipelines extra heavy cathodic protection and of continuing to install anodes at all places where leaks occur as they occur.

The first step involves a plant area of approximately 2,800,000 sq. ft., including 23 mi. of pipe of all sizes. The new installation will consist of 3,280 ft. of 14-in. cast iron pipe running east and north around the boundary of the zone and 2,160 ft. of 14 in. cast iron pipe running south and west along the other border of the zone.

As the new pipeline is laid, extra heavy cathodic protection will be supplied by placing a large number of anodes in the excavation in which the pipe will be laid. This will cut down anode installation cost and will get the anodes directly under the pipe where they are much less apt to be disturbed by any necessary excavations at a later date.

Then all existing pipelines in the zone will be connected to the heavily protected new lines. If there is no natural connection at a joint or similar point, pipes will be bonded metallically to the new protected lines. Thus the majority of current from the anodes will actually flow to nearby existing lines, since the coated and wrapped newer lines need so much less of the current for the present period.

A remaining 1,300 ft. of pipeline along the west side of the zone will not be new pipeline, and this with other existing pipeline in the zone, will be protected by their connections to the new, heavily protected lines *plus* being guarded by spot placements of anodes wherever there is a space for installation. The anodes that are trenched-in in this manner will be connected to the nearest pipe. Each anode will be encased in a premixed, dry powdered backfill specially processed for quick wetting.

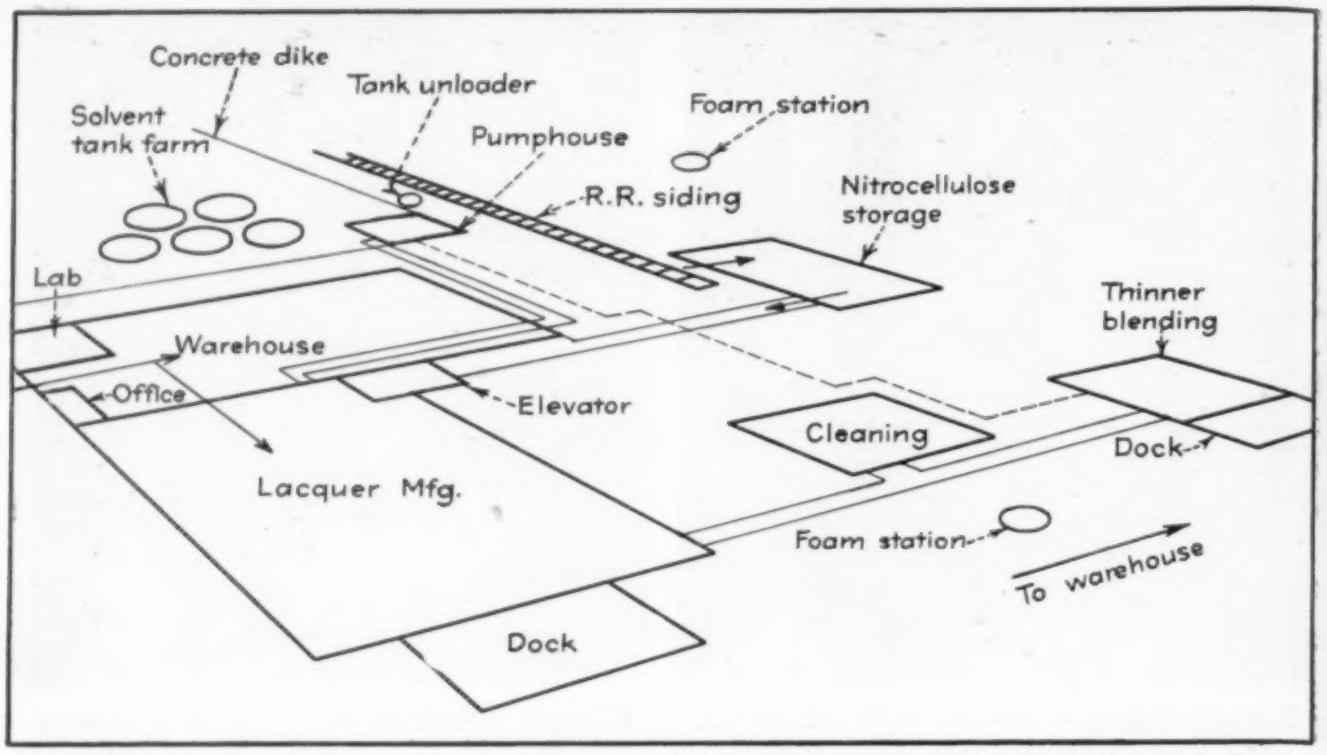
This whole portion of the three-step program is based on the premise that all pipelines within the zone are thus bonded together electrically so that all the lines are protected by the anodes installed.

The second step will be accomplished by installing anodes in a similar manner under all new pipe that is laid in other plant zones, and connecting this to all nearby existing pipe to afford protection for both old and new lines. This process will continue until all zones are protected in a like manner.

Third, the practice of using anodes at all leak locations will be continued. This will be continued in an improved and simpler manner by installing units in the same excavation necessary for repairing the leak, instead of by drilling an additional hole for a bare anode and its backfill.

A minimum of two anode packages will be used at every leak, or one for every 5 ft. of pipe exposed up to 25 ft. If more than 25 ft. of pipe is exposed, one anode for every 10 ft. of pipe beyond the first 25 will be used.

The first step alone is expected to cost an estimated $20,000 to $25,000 but will protect pipe costing some $330,000 to replace. The program is expected to reduce the leak rate as well as to extend the useful life of existing pipe by about ten years. It will also give the anodes the upper hand and reduce anode installation cost, permit regular scheduling of anode placement and replacement—for the anodes are located with an assumed ten-year replacement cycle—and give more assurance of uninterrupted anode operation.



LAYOUT of the new lacquer plant shows how the various buildings were segregated in order to minimize the hazards of operation and still provide a well coordinated flow of materials among them.

Quick Construction

Here's how the Arco Co. built a safe, efficient

E. G. Hart
Arco Co., Cleveland, Ohio

TO DESIGN and build a lacquer plant with the least possible delay—this was the first consideration in plans to replace the lacquer plant completely destroyed by fire at the Arco Co.

To provide maximum safety and efficient material handling—and do it economically—this was the determination of those responsible for the operation of the plant and safety of the workers.

The complete destruction of the old lacquer plant, a two-story frame building housing all operations, clearly demonstrated the danger of grouping hazardous operations in a single structure. With this point in mind it was decided to separate the following operations: (1) warehousing, (2) solvent storage and handling, (3) nitrocellulose storage, (4) lacquer manufacture, (5) thinner blending, and (6) equipment cleaning.

A 2-acre plot near the solvent tank storage farm was chosen as the site of the new plant. Here a 70 ft. x 80 ft. one-story brick building offered possibilities as a raw material warehouse and the nucleus of the plant. Starting with this building, the proposed plant was arranged as shown above. This layout segregated the various hazardous operations, and still provided a well coordinated flow of materials. Raw materials stored in the warehouse can be readily moved to the loading mezzanine by means of the hydraulic elevator. At the nitrocellulose storage building, drums are easily unloaded from the railroad cars and trucked down the ramp at the opposite side onto the elevator of the lacquer manufacturing building as needed. Finished materials filled and packaged on the first floor can be loaded and shipped from the dock at the west end of the building. In like manner, thinners filled in the solvent building are shipped directly from the storage dock. All solvents required in lacquer manufacturing and thinner production are metered automatically at the pump house, thus simplifying the piping and eliminating cumbersome weigh tanks and scales.

Plant Construction

Realizing the uncertain delivery of structural steel and the delay in erecting a conventional masonry building, it was decided to take advantage of the immediate availability and speedy erection of corrugated steel quonset type buildings to shelter the plant. The lacquer manufacturing building adjoining the brick warehouse has steel reinforced concrete floors, columns, beams, and mezzanine deck. The double row of 22 tanks (twenty 1,000 gal. and two 500 gal.) in the center of the building are set on a reinforced concrete slab supported on a masonry pier. The 4,000-lb. hydraulic elevator is enclosed in a brick structure, with all openings protected by heavy duty fire doors. For added

FINISHED PRODUCT shows the use of corrugated steel Quonset buildings to shelter the plant. The choice of this type of structure was due to its immediate availability and ease and speed of erection.

With Quonsets

and economical lacquer plant in just 18 weeks.

fire resistance, no exposed structural steel was used to support floors, tanks, equipment, etc. Adequate working height over the loading floor is obtained by erecting the quonset on a 4-ft. concrete wall.

The wall adjoining the brick warehouse is a masonry fire wall extending 12 ft. above the coping. In like manner, all windows and openings in the warehouse wall facing the solvent tank farm are bricked in as added fire protection.

The smaller quonset buildings are erected on concrete slabs with the conventional 6-in. curb. In order to obtain the proper floor elevation in the nitrocellulose storage building a 3-ft. concrete retaining wall was required.

The brick pump house is built as an integral part of the solvent tank farm dike with all threshhold and window openings at the same height as the dike wall. Any solvent spillage due to piping or equipment failure in the pump house would remain in the confines of the dike and not endanger the rest of the plant.

A separate tile field was installed south of the plant to handle drainage from the lacquer manufacturing, equipment washing and thinner blending buildings. In case of spillage or fire in the plant, no solvents or explosive vapors can drain into the industrial sewer system.

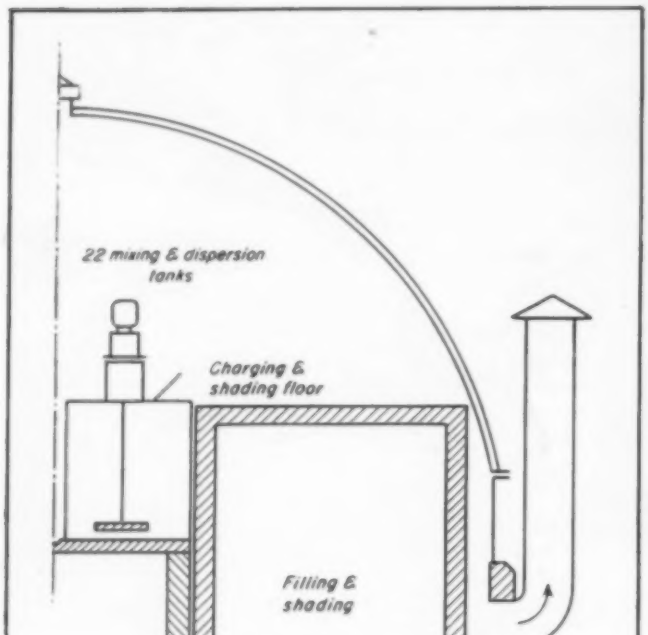
All buildings are equipped with wall ventilating fans. The four units in the lacquer manufacturing building produce a 3-4 min. air change, and are located near the floor level so as to remove the maximum amount of the heavier than air vapors.

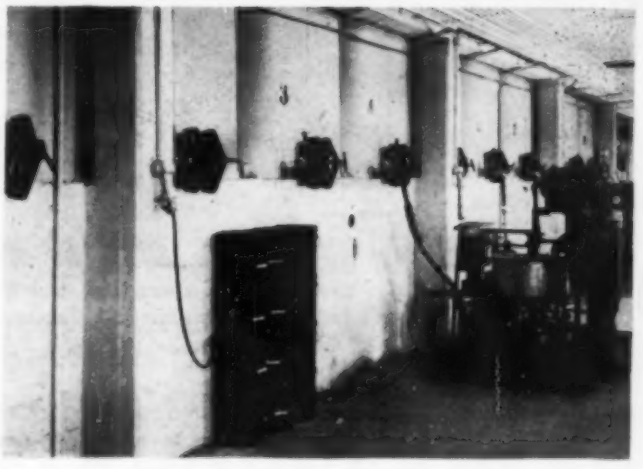
The interior surfaces of the quonset buildings are coated with approximately ¾-in. of a sprayed asbestos insulation. In addition to greatly reducing the heat loss, this fire resistant insulating layer is an excellent sound absorber. Heat is furnished to the various buildings by unit steam heaters connected to the central power plant. These heaters are placed near the ceilings to avoid contact with flammable materials used in the lacquer processing.

The 19 mixing tanks and 3 dispersion units, with a total operating capacity of 22,000 gal., are equipped with individual gear reduction drives and turbine type agitators (seven 5 hp., twelve 7½ hp. and three 25 hp.). These tanks are installed 5 ft. above the first floor and extend 3 in. above the mezzanine floor for ease and cleanliness in loading. In addition, seven smaller mixers and one heavy duty 7½-hp. unit on the first floor handle smaller batches of from 5 to 150 gal. The centrifuges, filling machines, pumps, conveyor, etc., on the first floor are arranged for efficient handling and packaging of the lacquer containers.

Solvents are pumped automatically to the 2,500 and 500 gal. tanks in the thinner blending building and are thoroughly mixed by side entering type agitators. The tanks are installed on 4 ft. concrete supports so that

UPPER LEVEL, where mixing units are arranged for floor-level filling to give the most ease in loading.





LOWER LEVEL, where mixing tanks on 4 ft. concrete supports permit filling of the drum containers by gravity.

Two levels of lacquer manufacturing building facilitate materials handling.

drums placed on the dial type floor scale can be filled by gravity.

In the pumphouse, two 1-hp. rotary pumps and two automatic meters handle all solvents for the lacquer manufacturing and thinner blending buildings. By double manifolding the inlet and outlet lines, the two pumps and meters can be used simultaneously. Two larger 3-hp. pumps handle the tank car unloading and solvent transfer for both the paint and lacquer plants.

Fire Protection

The warehouse, lacquer manufacturing, and nitrocellulose storage buildings are equipped with individual high hazard type sprinkler systems supplied by an 8-in. underground fire main. Inasmuch as the nitrocellulose storage building is not heated, a dry sprinkler system with heat actuated heads is used. The pumphouse is provided with a total flooding, automatic CO_2 system equipped with electrical power cut-off, automatic closures, etc. The equipment washing and thinner blending buildings are protected by a liquid foam hose station located near the structures. A dry powder foam generating station is located at the southeast corner of the plant for emergency protection of the solvent storage tank farm.

First aid fire protection is provided for the lacquer manufacturing building by four 75-ft. CO_2 hose racks supplied by four 50-lb. cylinders. In addition, dry powder and CO_2 hand extinguishers, fire blankets and respiratory masks are located throughout the plant.

A CO_2 total flooding automatic system is planned for the lacquer manufacturing building at a future date.

Safety Features

All floors in the plant are topped with a non-sparking and conductive (iron hardener) surface. The floors, as well as buildings, tanks and equipment are thoroughly grounded.

The electrical motors, lighting, fittings and wiring throughout the plant (with the exception of the non-hazardous dry stock warehouse) are all Class 1 Group D explosion proof. By locating all switches, magnetic starters, etc., at a central power panel in the warehouse the only controls required in the plant are the locking type push button stations at each motor.

The buildings all have two emergency exit doors.

Solvent storage tanks in the plant are equipped with flame arresting vents and liquid level indicators. The non-sparking aluminum covers on the mixing tanks are fitted with fusible links so as to be self-closing in case of fire.

All hand trucks are equipped with non-sparking and conductive wheels, grab hooks, etc. Funnels, measuring buckets, scoops and hand tools are of non-sparking metal.

Production wiped out by the fire was rescheduled at various other paint companies who generously offered their facilities and materials, sometimes even at an inconvenience to their own commitments. Contractors and suppliers went "all out" to furnish scarce material and equipment for the new plant. Without this wholehearted cooperation, the plant could not have been completed and production resumed just 18 weeks after the fire.

Corrosion *by* Sulphates

From the files of the Nickel Co. come actual plant data on the corrosion of metals by a number of inorganic sulphates.

W. Z. Friend
The International Nickel Co., New York

Ammonium Sulphate

Common processes for the manufacture of ammonium sulphate in byproduct plants are direct systems in which gas from the coke-ovens, after cooling and removal of tar, is reheated, combined with ammonia gas from the ammonia still, and delivered directly to saturators or scrubbers. In saturators, the gases are bubbled up through a layer of ammonium sulphate solution containing about 5 to 6 percent free sulphuric acid, the temperature being maintained at about 140 deg. F. The ammonium sulphate crystals which are formed settle to the bottom of the saturator, frequently equipped with a cone bottom, and the crystal slurry is drawn off continuously by pumping to settling tanks. The crystals are sent to centrifuges or vacuum filters for removal of mother liquor, washing and drying, and are automatically discharged into sulphate storage bins. The mother liquor is heated and returned with necessary make-up acid to the saturators. Sulphuric acid concentrations in the saturators may become as high as 10 or 12 percent.

In one system the customary type of saturator is replaced with a scrubber in which the ammonia-rich gas passes upward through a packed tower countercurrently to a stream of ammonium sulphate solution containing from 4 to 10 percent sulphuric acid, sprayed in at the top. The solution leaving the scrubber is pumped to a crystallizer from which the settled crystal slurry is pumped to a slurry tank and thence to centrifuges or vacuum filters. Temperature of the acid solution in the scrubber is normally about 122 deg. F.

The results of plant corrosion tests in the production of ammonium sulphate by these methods are given in Table I. Test 1 of Table I was made in an operating saturator. Tests 2 and 3 of this table were made in the mother liquor mixing tank and crystallizer respectively of a scrubber-type system. Good performance to be expected from Monel in practically all parts of the production systems where acid conditions are encountered. In modern plants Monel is being used for the construction of complete saturators and scrubbers, mother liquor tanks, crystal settling tanks, centrifuges, vacuum filters and accessory equipment. In continuous centrifugals, Monel has been used for baskets, discharge housings, wear plates and fastenings. The results of a corrosion test in the mother liquor discharged from a centrifugal are shown in Table II. Screens are commonly Type 316 stainless steel.

Monel has been used for immersed saturator pumps handling the acid liquor and crystals. Such pumps are in good condition after more than 5 years continuous service. In most systems, the nickel-chromium-molybdenum-iron alloys are giving good performance in handling these solutions.

There has been some production of ammonium sulphate by reaction of synthetic ammonia and sulphuric acid in saturator systems. Where acid temperatures are permitted to reach rather high levels such as 200 to 230 deg. F. due to heat of reaction, caution should be used in the application of Monel since the combination of such temperatures and velocity conditions is likely to cause accelerated corrosion of Monel. Monel saturators have given satisfactory performance in "synthetic" systems operating under vacuum where acid temperatures are kept below 140 deg. F. If air-agitation is used in the production of ammonium sulphate, caution should be used in the application of Monel.

Table I—Ammonium Sulphate Production

Test 1: Immersed in saturator in mixture of saturated ammonium sulphate solution, crystals and 3 to 10% sulphuric acid solution near inlet of rich coke-oven gas. Considerable agitation. Temperature 122–140 deg. F. Duration of test 77 days.

Test 2: Immersed in mother liquor mixing tank in mixture of saturated ammonium sulphate solution and 5% sulphuric acid solution. Temperature 100–116 deg. F. Duration of test 33 days.

Test 3: Immersed in crystallizer in mixture of saturated ammonium sulphate solution, crystals and 5% sulphuric acid solution. Temperature 100–116 deg. F. Duration of test 33 days.

Material	Corrosion Rates, In. per Yr. Test 1	Test 2	Test 3
Monel	0.0055	0.0055	0.0029
"K" Monel	.....	0.0038	0.0016
"S" Monel	.....	0.0047	0.0016
Nickel	0.0070	0.0052	0.0029
Inconel	0.0008[1]	0.0037[1]	0.0009
Hastelloy A	0.0009	0.0015	0.0005
Worthite	.....	<0.0001	<0.0001
Ni-Resist (Type 1)	0.019	0.0054	0.0052
Cast iron	0.060	0.045	0.036
Mild steel	0.036	.....	.....
Chemical lead	.....	0.0011	0.0051

[1] Pitted to max. depth of 0.006 in.

Table II—Centrifuging

Immersed in sulphuric acid slurry discharged from centrifuge during centrifuging and washing of ammonium sulphate crystals. Aerated. Temperature 212 deg. F. Duration of test 36 days.

Material	Corrosion Rate, Ipy
Monel	0.007
Nickel	0.008
Inconel	0.0002
Durimet 20	0.0001
Hastelloy A	0.008
Ni-Resist (Type 1)	0.019
Cast iron	[1]

[1] Completely corroded away. Original thickness 0.187 in.

Aluminum Sulphate

Aluminum sulphate usually is made by digesting finely-ground bauxite or alumina with boiling sulphuric acid, frequently with air agitation during mixing. The insoluble material is allowed to settle and the aluminum sulphate solution drawn off and sent to evaporators where it is concentrated usually to about 57 percent $Al_2(SO_4)_3$. The hot sirupy liquid is poured into pans where it solidifies on cooling and subsequently is crushed and ground for shipment.

Aluminum sulphate normally is

marketed in two grades, commercial (0.5% max. iron) and iron-free (0.005% max. iron). The iron-free grades may be made from alumina hydrate (Bayer process) or from exceptionally pure grades of alumina. In the production of commercial grade aluminum sulphate from crude bauxite, the iron content of the bauxite when converted to ferric sulphate, makes the solution highly oxidizing. This combined with the boiling temperature makes the extraction or digestion process corrosive to most of the common metals except lead as indicated in Test 2 (liquid) of Table III. Test 1 of this table gives the results of tests in the production of iron-free grade aluminum sulphate from extremely low iron-content alumina. In this case Monel could be used for digester tanks and heating coils. In the digestion of crude bauxite, corrosive conditions are considerably less severe in the acid vapor above the liquid since ferric sulphate is not present to an appreciable extent, so that Monel is used for parts which do not enter the liquid (Test 2b).

In the evaporation of commercial grades of aluminum sulphate corrosion rates due to ferric sulphate usually will be too high for the economical use of Monel evaporators as shown by most of the tests in Table IV. In these cases lead can be used for evaporating equipment and the nickel-chromium-molybdenum-iron alloys frequently can be used for other parts. Monel is used for evaporator covers where in contact with acid vapor only. Test 7 of this table shows the results of corrosion tests in the evaporation of iron-free grade aluminum sulphate and indicates the suitable performance of Monel under these conditions. Concentrated iron-free aluminum sulphate is poured on nickel-clad steel floor plates for cooling to prevent iron contamination.

In the use of aluminum sulphate the solid salt usually is dissolved in hot water to provide the desired concentration of solution. Some free sulphuric acid may be present and the corrosiveness of the solution depends upon the concentration of ferric sulphate present. The best grades of paper-maker's alum are "iron-free" with very little free acid content and under these conditions, Monel can be used for alum dissolving and storage tanks. However some grades of alum used by paper mills may be relatively high in iron resulting in higher corrosion rates. The corrosion test results given in Table V were obtained during the dissolving of 2 lb. of alum per gallon of water in a paper mill. The test results in Table VI were obtained during storage and handling of 24 percent and 15 percent alum solutions in paper mills. Table VII gives the results of a test in the cylinder vat of a paper board machine where pH ranged from 2.8 to 8.5 and there was some aeration of the solution due to movement of the cylinder. In most of these applications, Type 316 stainless steel is the preferred ma-

Table III—Aluminum Sulphate Extraction

Test 1: Immersed in dissolving tank during treatment of very low iron-content alumina with sulphuric acid to produce "iron-free" aluminum sulphate. Agitated with air for short periods. Duration of test 21 days. Temperature boiling at 220–250 deg. F.

Test 2: Dissolving of high iron-content beauxite in sulphuric acid to produce aluminum sulphate. Duration of tests 50 and 81 days. Temperature of solution, boiling.
a. Immersed in liquid in tank, 50 days.
b. In vapor above liquid, 81 days.

Material	Corrosion Rate, In. per Yr. Test 1	Test 2a	Test 2b
Monel	0.0041	0.17	0.008
Nickel	0.002	[1]	.....
Inconel	.....	[1]	.....
Hastelloy C	0.006	.....	.....
Illium R	0.006	.....	.....
Durimet 20	0.014	.....	.....
Pioneer metal	.....	0.088	.....
Ni-Resist (Type 1)	.....	0.74	.....
Chemical lead	.....	0.016	0.005

[1] Completely corroded away. Original thickness 0.031 in.

Table IV—Aluminum Sulphate Evaporation

Test 1: Immersed in liquid in alum evaporator. Duration of test 100 days. Temperature 140–240 deg. F.

Test 2: Immersed in liquid in alum evaporator during concentration from 26 to 57% $Al_2(SO_4)_3$. Iron content 0.02% as Fe_2O_3 and 0.8% as FeO. Duration of test 44 days. Temperature 140–240 deg. F.

Test 3: In vapor and condensate from alum evaporation from 26 to 57% $Al_2(SO_4)_3$. Duration of tests 81 days. Temperature of vapor 140–240 deg. F.
a. In vapor in evaporator.
b. In condensate from vapor.

Test 4: Immersed in liquid in alum evaporator during concentration from approx. 24 to 57% $Al_2(SO_4)_3$. Iron content 0.04% as Fe_2O_3 and 0.14% as FeO. Duration of test 20 days.

Test 5: In alum evaporator during concentration of aluminum sulphate. Duration of tests 48 and 90 days. Temperature 150–245 deg. F. Free H_2SO_4 0.03%.
a. In liquid, 48 days.
b. In vapor, 90 days.

Test 6: In alum evaporator during concentration from 20 to 60% $Al_2(SO_4)_3$. Duration of tests 36 days. Temperature 150–245 deg. F.
a. In liquid.
b. In vapor.

Test 7: Immersed in evaporator during concentration of "iron-free" aluminum sulphate to 55% $Al_2(SO_4)_3$ concentration. pH 2–3. Duration of test 27 days. Temperature boiling at 225–235 deg. F.

Material	Corrosion Rate, In. per Yr. Test 1	Test 2	Test 3a	Test 3b	Test 4	Test 5a	Test 5b	Test 6a	Test 6b	Test 7
Monel	0.0055	0.016	0.022	0.0012	0.032	.....	0.018	0.061	0.047	0.0004
Nickel	.....	0.059	.....	.....	0.029	.....	0.047	0.13	0.11	0.0015
Inconel	.....	0.051	.....	.....	.....	.....	0.045	0.16	0.11	0.0053
Hastelloy A	.....	.....	.....	.....	.....	0.072	0.015	.....	.....	.....
70–30 Copper-nickel	.....	.....	0.024	0.0045	0.065	.....	.....	0.008	0.066	.....
Ni-Resist (Type 1)	.....	0.30	.....	.....	.....	0.061	0.039	0.026	0.10	.....
Cast iron	.....	.....	.....	.....	.....	0.26	0.083	0.17	0.13	.....
Mild steel	.....	.....	.....	.....	.....	.....	0.11	[1]	0.15	.....
Chemical lead	0.0032	.....	0.002	0.0066	0.0013	0.008	0.003	0.0007	0.001	0.0023

[1] Corroded entirely away during test. Original thickness 0.062 in

Table V—Dissolving Alum in Paper Mill

Immersed in alum dissolving tank during dissolving of alum in water. Temperature 110–120 deg. F. Tank in use 4 hours per day for 44 days. Rates based on this use and on continuous exposure.

Material	Corrosion Rate, In. per Yr. In Use 4 Hr. per Day	Continuous Use
Monel	0.006	0.036
Nickel	0.008	0.049
Ni-Resist (Type 1)	0.090	0.53
Cast iron	0.065	0.39
Pioneer metal	<0.0001	0.0002
Mild steel	0.054	0.32
Chemical lead	0.0027	0.016
18–8 Mo Stainless (Type 316)	<0.0001	<0.0001

Table VI—Alum Storage in Paper Mills

Test 1: Immersed in 24% aluminum sulphate solution in storage tank. Duration of test 62 days. Temperature 90–100 deg. F.

Test 2: Immersed in 15% aluminum sulphate solution in alum head tank. Duration of test 45 days. Temperature 110 deg. F. pH 3.0.

Material	Corrosion Rate, In. per Yr. Test 1	Test 2
Monel	0.0026	0.0060
Nickel	0.0030	0.0060[1]
Inconel	.....	<0.0001
Hastelloy B	.....	0.0053
Hastelloy C	.....	<0.0001
Pioneer metal	<0.0001	.....
Ni-Resist (Type 3)	.....	0.0086
Ni-Resist (Type 1)	0.0036	0.014
Cast iron	.....	0.65[2]
Mild Steel	0.011	0.19
Chemical lead	0.0006	.....
18–8 Mo Stainless (Type 316)	<0.0001	<0.0001

[1] Perforated by pitting. Original thickness 0.031 in. [2] Completely graphitized.

Table VII—Alum Solution in Cylinder Vat

Immersed in alum solution in Paper Board cylinder vat. pH range from 2.8 to 8.5. Average pH 5.65. Duration of test 33 days. Temperature 91 deg. F.

Material	Corrosion Rate, Ipy
Monel	0.006
Nickel	0.0024
Inconel	<0.0001
Ni-Resist (Type 1)	0.021
Cast iron	0.024
Mild Steel	0.015
18–8 Mo Stainless (Type 316)	<0.0001

terial for dissolving or storage tanks due to the possibility of some ferric sulphate being present. The nickel-chromium-molybdenum-iron alloys are used for pumps and valves.

Inorganic Acid Sulphates

Non-Oxidizing Sulphates—Aqueous solutions of most of the inorganic acid sulphates hydrolyze to a certain extent to form dilute sulphuric acid, particularly at temperatures associated with their evaporation. Some of them contain free acid in the crystalline salt. Monel has useful resistance to solutions of most of the non-oxidizing acid sulphates and has numerous applications in the evaporation and handling of such solutions. Nickel and Inconel usually are somewhat less resistant than Monel in the hot solutions though having a number of applications where special conditions, such as necessity for freedom from copper pick-up by the solution dictate their use. The Ni-Resist alloys can be used under some of the more dilute acid conditions and usually are considerably more resistant than cast iron.

Applications in the handling of ammonium sulphate and aluminum sulphate previously have been described. Other examples include the use of Monel evaporators, or evaporator or heater coils and tubes for zinc sulphate, nickel sulphate, sodium bisulphate and manganese sulphate, and of nickel evaporators for stannous sulphate plating solutions. Monel lined rotary dryers are used for drying zinc sulphate and acidified barium sulphate.

Table VIII——Mixture of Ferrous Sulphate, Titanium Sulphate and Sulphuric Acid

Immersed in Dorr settling tank in mixture containing 19.5% sulphuric acid, 20% ferrous sulphate, and 10% TiO_2 as titanium sulphate. Temperature 122–158 deg. F. Duration of test 24 hr.

Material	Corrosion Rate, Ipy
Monel	0.026
Nickel	1.28
Inconel	0.72
Hastelloy B	0.0032
Ni-Resist (Type 1)	0.55
Cast iron	8.45
Mild steel	[1]
Chemical lead	0.010

[1] Corroded away during test. Original thickness 0.062 in.

Table IX—Hot Manganese Sulphate

Plant test in liquid in evaporator during concentration of manganese sulphate from 1.250 to 1.350 specific gravity. Duration of test 11 days. Temperature 220–240 deg. F.

Material	Corrosion Rate, Ipy
Monel	0.0048
"S" Monel	0.0037
Nickel	0.0029
Inconel	0.0010
Hastelloy C	.....
Ni-Resist (Type 2)	0.0073
Cast iron	0.024
Mild steel	0.024

Table X—Evaporation of Nickel Sulphate Solution From 30 to 50 Deg. Be.

Immersed in open type steam heated evaporator. Concentration prior to crystallization. Nickel content from 115 to 238 g. per liter. Temperature 150–212 deg. F. Duration of test 232 days.

Material	Corrosion Rate, Ipy
Monel	0.001
Nickel	0.0008[1]
Inconel	<0.0001
Chemical lead	0.006

[1] Pitted to max. depth of 0.030 in.

Table XI—Evaporation of Sodium Aluminum Sulphate Solution From 20 to 60 Percent

In liquid and vapor phases in continuous evaporator. Temperature of liquid approx. 244 deg. F. Duration of test 13 days.

Material	Corrosion Rate, In. per Yr. In Liquid	In Vapor
Monel	0.017	0.029
Nickel	0.25	0.046
Inconel	0.16	0.025
70-30 Copper-nickel	0.008	0.062
Ni-Resist (Type 1)	0.045	0.050
Cast iron	1.46	0.10
Mild steel	[1]	0.10
Chemical lead	0.064	0.003

[1] Corroded away during test. Original thickness 0.062 in.

Table XII—Zinc Sulphate Production

Immersed in dissolving tank during dissolving of zinc from waste product in 53 deg. Be. sulphuric acid. Duration of test 31 days. Temperature 160–200 deg. F.

Material	Corrosion Rate, Ipy
Monel	0.0084
Nickel	0.0093[1]
Inconel	0.0078
Hastelloy B	0.0024
Durimet 20	0.0092
Mild steel	0.10

[1] Pitted to max. depth of .004 in.

Table XIII—Evaporation of Zinc Sulphate Solutions

Test 1: Immersed in open evaporator during evaporation to concentrated zinc sulphate solution. Temperature boiling. Duration of test 34 days.

Test 2: Immersed in open evaporator during evaporation of mixture to concentration of 33.7% $ZnSO_4 \cdot 6H_2O$, 8.8% zinc chloride and 1% ferrous sulphate. Temperature 180–230 deg. F. Duration of test 8 days.

Test 3: Immersed in evaporating pan in saturated zinc sulphate solution containing zinc sulphate crystals. Vigorous agitation. Temperature 212–225 deg. F. Duration of test 35 days.

Material	Corrosion Rates, In. per Yr. Test 1	Test 2	Test 3
Monel	0.003	0.0055	0.020
Nickel	0.003	0.0029	0.025
Inconel	0.0012	0.0025	0.022
Hastelloy A	.....	.....	0.005
Hastelloy C	.....	<0.0001	.....
Chemical lead	.....	.....	0.006

Plant or laboratory corrosion tests have been made in solutions of most of the common acid sulphates. The results of some of the tests are given in Tables VIII to XIV inclusive.

Oxidizing Acid Sulphates—Monel, nickel, Hastelloys A, B and D, and the iron-nickel and Ni-Resist alloys usually are severely attacked by solutions of oxidizing acid salts, while such materials as Hastelloy C, Illium, the nickel-chromium-molybdenum-iron alloys are resistant. Inconel and nickel-chromium alloys frequently are resistant except at high temperatures. Inconel parts are used on Oliver filters in a wet process for extracting copper from copper slimes containing 12 percent sulphuric acid at 110-120 deg. F. Study has been made of the performance of various materials in potassium persulphate solutions in view of the use of this chemical as a catalyst. The results of a number of these tests are given in Table XV. Inconel and the stainless steels generally are suitable for handling both potassium and ammonium persulphates.

Table XIV—Concentrated Solution of Basic Chromium Sulphate

Immersed in storage tank. Temperature 200 deg. F. Duration of test 30 days.

Material	Corrosion Rate, Ipy
Monel	0.025
Nickel	0.034
Inconel	0.042
Hastelloy B	0.0008
Hastelloy C	0.0001
Durimet 20	0.032
Ni-Resist (Type 2)	0.036
Cast iron	0.59
Mild steel	[1]

[1] Corroded away during test. Original thickness 0.062 in.

Table XV—Potassium Persulphate

Test 1: Plant test in 4.8% potassium persulphate. Test spool immersed at bottom of storage tank. No agitation. Temperature 90 deg. F.

Test 2: Plant test in 4% potassium persulphate. Test spool immersed in liquid in storage tank. No agitation. Room. Duration of test 42 days.

Material	Corrosion Rates, In. per Yr. Test 1	Test 2
Inconel	0.0	<0.0001
Nickel	0.0008[1]	0.0014[1]
Monel	[2]	.....
Hastelloy C	.....	0.0001
Durimet T	0.0	<0.0001
Ni-Resist (Type 1)	[4]	.....
Cast iron	[4]	.....
Chemical lead	0.086	.....
18-8 Stainless (Type 304)	0.0	<0.0001
18-8 Mo Stainless (Type 316)	0.0	<0.0001
35 Ni-15 Cr Stainless (Type 330)	.....	<0.0001
20 Cr-25 Ni Stainless (Type 311)	.....	<0.0001

[1] Pitted to maximum depth of 0.003 in. in crevice. [2] Perforated by pitting in crevice. Original thickness 0.031 in. [3] Corroded away during test. Original thickness 0.031 in. [4] Corroded away during test. Original thickness 0.187 in.

Fifth National Chemical Exposition, Chicago Coliseum, Chicago, Oct. 12-16, 1948.

We Visit the Chem Show

"*Chem & Met*" sent three editors out to Chicago last month to cover the Chemical Show. Here is a report on what was new since the last show two years ago.

DURING the five day period from October 12 to 16, somewhere between 40,000 and 50,000 engineers and chemists passed through the gates of the Chicago Coliseum to examine the displays of the fifth showing of the National Chemical Exposition which, since 1940, has been giving the Middle West a first-hand view of what's new in chemicals and in processing equipment.

About the same size as the fourth exposition in 1946, the exhibitors totaled about 200 with the exhibits split roughly into 17 percent for laboratory equipment, 4 percent for publishers, 15 percent for chemicals, and 64 percent for plant equipment, control instruments, construction materials and packaging machinery and supplies. The proportion of space devoted to laboratory apparatus seems to have been increasing slightly in recent years.

The present report confines itself to developments that are new since the last Chicago Chemical Exposition in 1946, and is limited to the exhibits of equipment for plant use, control instruments and similar devices, materials of construction, and packaging equipment and supplies. About 70 of the exhibits fell within this category.

Construction Materials

Several developments that are classified under the construction materials heading were shown by the Aluminum Co. of America, Pittsburgh. The company's aluminum beer barrel has been modified for use as a container for chemicals by replacing the old wooden bung with an aluminum screwed closure. Another modification has been to place handles on top of a shorter barrel so that the container can be used as a carboy for easy tilting and pouring. Both units are internally clad with high purity aluminum for extra corrosion protection. This concern also showed a new "sausage-type" aluminum anode for corrosion prevention in hot water heaters. The aluminum is in several pieces, strung on a central steel wire, to facilitate installation where headroom is limited. Thin aluminum tubing was also exhibited, as a replacement for copper for instrument air lines and similar applications. A new range of sizes of the company's refractory alumina pebbles was displayed, for use in pebble heaters and as a graded support in the bottom of towers and reactors to support tower packing or catalyst particles. Fine-mesh spherical alumina particles containing 5 percent silica are going increasingly into fluid catalyst processes, complementing the silica catalysts previously used.

A new development in the booth of Andrews-Knapp Construction Co. and Knapp Mills, Inc., New York, was homogeneous lead covered copper piping for steam pressures as high as 150 psi. The composite material gives the corrosion resistance of lead, coupled with considerably higher heat transfer coefficients and strength owing to the copper base.

Another composite metal, consisting of Type 316 stainless steel and copper, which is being produced for

American Clad Metal Co., Carnegie, Pa., was shown by the Crucible Steel Co. of America, New York. Available now only in cooking utensils, this composite will probably later be available for equipment fabrication. Crucible also showed embossed stainless steel sheets, intended primarily for architectural purposes, but possibly also of interest where the embossed depressions will facilitate drainage. Another stainless steel manufacturer, Eastern Stainless Steel Corp., Baltimore, Md., showed samples of its new "Hundred-Grit" finished stainless, a hot-rolled, annealed, pickled and ground sheet suitable for many purposes for which cold-rolled, dull-finished steel was formerly used, and giving the added advantage of a ground surface.

Impervite is the name of a new line of impervious graphite introduced by General Ceramics & Steatite Corp., Keasbey, N. J. Plate heaters, concentric tube exchangers, tubular heat exchangers, bayonet type exchangers, pipe and fittings were shown, the newest unit being a 19-tube heat exchanger with a shell of chemical stoneware, for use where the corrosive material must be on the shell side.

Many applications of Teflon were shown at the exposition. For example, the Hasco Valve & Machine Co., Milwaukee, introduced a new line of Hastelloy and stainless steel valves having a Teflon plug facing and Teflon seal rings. This concern also showed new stainless steel gage glass connections and strainers.

The Haveg Corp., Newark, Del., displayed larger tanks and valves of conventional Haveg material than have previously been made, together with a new material, Haveg 48. This material is an unfilled phenolic plastic having better machining characteristics, permitting threaded fittings, bolts, etc.

New types and sizes of its impervious graphite grid-type immersion heat exchanger for heating or cooling were shown by the Heil Process Equipment Corp., Cleveland. This exchanger employs vertical tubes in groups of four or eight and is available in standard sizes from 8 to 35.8 sq. ft. of exchange surface. This concern also exhibited its new Heilex No. 445, a vinyl plastic coating or lining material for resistance to alkali and acid solutions including even oxidizing acids.

One of the features of the exhibit of Lukens Steel Co., Coatesville, Pa., was the finish obtainable on clad steel plates as pickled in its newly installed sodium hydride pickling plant. The process gives a good finish without grinding or sandblasting and assures a smooth scale-free surface.

Several new developments in Karbate impervious graphite were featured in the booth of National Carbon Co., New York. Among these was a new one-piece bubble cap with the cap and chimney integral to facilitate installation and replacement. New or improved heat exchangers included the Series 10 type, a double-pipe heater or cooler with inner Karbate tube and outer steel tube; and the Karbate economizer, also of the concentric type, with both inner and outer tubes of Karbate. This company's new hydrochloric acid absorber was prominently displayed. This package type unit includes all accessories for automatic operation and has a capacity from 2¼ to 16 tons of acid per day, in a floor space of only about 13 sq. ft.

New protective coatings introduced by the Plastic Lining Corp., Chicago, are vinyl co-polymers with aromatic hydrocarbon solvents and inert pigments. One type, Line-Tite is intended for heavy-duty tank lining service, and another type, Vinyl-Clad, for general maintenance purposes.

As a new product in its line, Sivyer Steel Casting Co., Chicago, showed Durimet 20 which this concern is now casting under the trade name of Sivyer 20.

F. M. DeBeers & Associates, Chicago, showed a new line of metal pipe coated on the inside by spraying with a vinyl plastic, produced by Stalpic Coating Corp. It is claimed that vinyl plastisols can be used to give an excellent interior finish.

A complete new line of gaskets, introduced under the name of Chemiseal, was featured by the U. S. Gasket Co., Camden, N. J. Containing Teflon, these include jacketed and solid gaskets, Teflon-filled spiral-wound gaskets, valve packings, machined and molded rings, high speed shaft packings, braided and shredded packings. Special machined and molded products of Teflon were also exhibited, as well as a new valve put out by Aloyco Co., employing a stainless steel needle valve with a Teflon seat and molded Teflon shaft packing.

New construction materials exhibited by the U. S. Stoneware Co., Akron, included a new type of Tygon tubing covered with a plastic-coated, braided cloth coating, for pressures to 250 psi., and Duralon molded tanks made from impregnated Fibreglas and a furane-base resin.

Fluid and Heat Flow

Fluid Flow—A new line of pumps with a non-leaking seal has been introduced by Alsop Engineering Co., Milldale, Conn. The seal consists of a stationary grooved carbon block lapped to seal tightly against a rotating porcelain ring.

For operation in the range from 500 to 0.1 microns, Distillation Products, Inc., Rochester, N. Y., showed a new type oil diffusion pump which will handle 400-500 cfm. at 1 micron pressure. This unit is designated as the Type KB 150 Booster.

A lubricated cylindrical plug which is split diagonally so that wedging action automatically seals the valve in the closed position was shown by the Homestead Valve Mfg. Co., Corapolis, Pa. Known as the "Self-Seald," the valve is built in sizes from 1 to 6 in. and features, in addition to its simple sealing principle, automatic compensation for wear.

Several new lines of pumps were introduced by Jabsco Pump Co., Burbank, Calif. These pumps, a rotary type employing a simple flexible rotor, were shown in new construction materials, and newly equipped with ball bearings.

A variation of its Type G packingless, self-priming centrifugal pump, known as Model B, was shown by the LaBour Co., Elkhart, Ind. The new unit has grease lubricated bearings with protection against the entrance of gases and liquids, and a provision to vent the space between the pump and bearing bracket to remove explosive or toxic gases.

Featured by the Pfaudler Co., Rochester, N. Y., was a new Type 316 stainless steel flush outlet valve for kettles and similar equipment. The valve is quick opening and also has a hand wheel for adjusting the amount of opening and for rotating the disk against the seat to remove solid particles.

Several new models were introduced in the line of turbine-type pumps manufactured by the Roy E. Roth Co., Rock Island, Ill. These include pumps built of stainless steel, Hastelloy and Monel metal. Only bronze and steel types were made formerly. This company showed two packaged condensate return units having 20 gal. receivers and designated at Types UA and XA.

Indicative of the trend toward mechanical sealing of centrifugal pump shafts was a new seal introduced by Worthington Pump & Machinery Corp., Harrison, N. J. This seal is designed specifically for corrosion resistance and is made largely of Worthite with a seal of carbon or graphite against Worthite. The Teflon shaft packing rotates with the shaft. The seal features ready adjustment and disassembly for maintenance. It is provided with a cooling water jacket and

the adjusting pressure is self-indicating.

Heat Flow—A new series of heat exchangers designed for quick opening and removal of the tube bundle was exhibited by Graham Mfg. Co., New York. The covers are attached at each end by a clip and single bolt which acts along the axis of the unit. The bolt at the floating head end of the tube bundle can be used as a means of loosening the tube bundle. Produced in both single and two-pass models, these exchangers are available in sizes from 24 to 120 sq. ft.

For use in boilers and direct-fired stills, the Selas Corp. of America, Philadelphia, showed a new gas burner which can develop up to 14,000,000 Btu. per hr., with a 14 ft. long flame, using air pressure of only 1 lb. Most units operating at present are in the petroleum industry.

An improved model of its plate type heat exchanger was shown by Walker-Wallace, Inc., Buffalo. The frame is of stainless rather than enameled steel and the plates are removable for easy cleaning whereas, in previous designs, the plates were permanently hung on a shaft.

Instruments and Feeders

The featured exhibit of Consolidated Engineering Corp., Pasadena, was its new leak detector, a simplified mass spectrometer tuned to helium, which is used as a probe gas. The unit is provided with a loud speaker which, in the event a leak is detected, gives off a note indicating the magnitude of leakage. The unit is designed for ease of operation and maintenance. This concern also showed the Consolidated-Nier isotope-ratio mass spectrometer which was developed particularly for use in tracer studies for measuring the ratio of the tracer isotope to the naturally occurring isotope in samples of gases produced from materials obtained from different parts of a system under test. The method thus serves to establish the distribution in the system of the original materials labeled with the rare isotope.

To improve chlorine feed to water treating systems, the Everson Mfg. Corp., Chicago, Ill., has introduced a new automatic chlorine feeder known as the Airo-Matic which is completely automatic in operation, proportioning the chlorine fed by measuring the water flow rate, over a flow range of 20 to 1. This wide range is secured by having two meters, the second cutting in and adding to the total available chlorine flow when a demand for half the entire capacity of the unit is reached.

To permit conductivity measurements on distilled water and condensate where the leaching of glass used in a temperature compensator could not be permitted, Industrial Instruments, Inc., Jersey City, has introduced a new conductivity recorder using as a temperature compensator a Thermistor negative temperature resistor. This concern also showed a new battery-operated Sol-U-Bridge which is identical in operation to the company's a.c. instruments but is made portable by operating on eight flashlight cells.

Infilco, Inc., Chicago, showed an improved liquid chemical feeder which is driven either by liquid or by air pressure. The capacity is 12 gal. per hr. and the operating range is from 10 percent to full capacity, with flow regulated by means of a calibrated dail.

Formerly actuated only by batteries, the meter manufactured by Hart-Moisture-Meters, New York, is now available in an a.c. line-operated model which requires no warm-up time and has no moving parts.

Now available in both strip-chart and round-chart models, a new recorder-controller utilizing a pneumatic control system has been introduced by the Leeds & Northrup Co., Philadelphia. The unit employs an electrical measuring system, with the pneumatic control end provided with both reset and derivative action to return the controlled variable quickly to the set point, regardless of demand variations.

Instrument developments exhibited by Mine Safety Appliances Co., Pittsburgh, included a new micro-projector for dust sample counting, which is portable and gives a magnification of 1,000 X. This concern also showed a color-change type carbon monoxide indicator which weighs only a few ounces and yet is said to give an accuracy comparable to other methods.

New developments in proportioning pumps for very small flows were featured by Proportioneers, Inc., Providence. The Vit-O-Feeder, designed initially to feed vitamin additives, handles continuous flows of liquids down to 1 cc. per hr. Another machine, designed to handle small flows of materials which might settle out if not kept in constant movement, employs two proportioning pumps in series, set at slightly different capacities, the difference representing the amount fed. For example, to handle 2 cc. per min., one pump handles 600 cc., the other 598 cc. with the difference of 2 cc. discharged as the product stream.

Two new proportioning pumps were demonstrated by the Milton Roy Co., Philadelphia. The new Constametric, although it is a variable volume pump of the piston type, delivers at an absolutely constant rate by avoiding the effect of harmonic motion of the pistons, and instead supplying linear motion in an ingenious manner. This company's new Airometric proportioning pump is conventional so far as the pump end is concerned, but employs an air motor drive equipped with a governor to avoid speed change with variations in driving air or gas pressure.

For feeding small flows of solid material under accurately metered conditions, Wallace & Tiernan, Newark, N. J., showed its new Merchen scale feeder which is of the scale-balanced belt type. Various sizes have capacities ranging from ½ lb. to 12 cu.ft. per min. The weighing section of the belt automatically controls the speed of a pair of feed screws so that any variation in density or other characteristics of the feed is automatically compensated for immediately.

Kettles and Mixers

Kettles and Containers—Alsop Engineering Co., Milldale, Conn., has abandoned its line of glass-lined tanks and is introducing a complete line of stainless steel tanks up to 250 gal. capacity.

Agitator shafts for its glass lined vessels are now being provided with a new mechanical seal by Glascote Products, Inc., Cleveland. The unit features a stationary carbon seal ring and either a neoprene or a Teflon gasket. Maximum operating pressure is 150 psi. The company also showed a new combination thermometer well and baffle, part of the glass-covered thermometer tube being flattened to give baffling. This well is tipped with a metal end to facilitate heat transfer, any desired metal being available. The tip is gasketed with a Teflon ring.

Groen Mfg. Co., Chicago, showed a new line of self-contained Dowtherm-jacketed, gas-heated cooking kettles with automatic temperature control. The unit is shipped complete with Dowtherm, the only connection required being for gas. Sizes from 60 to 500 gal., for temperatures up to 700 deg. F., are provided. This con-

Correction

CONSTRUCTION MATERIALS FOR JET PUMPS
Chemical Engineering, September 1948

A NUMBER of serious mistakes were made in this article. All of them were in the table and text on pages 116 and 117 of the September issue. Corrections are printed on page 266 of this issue.

cern also had a new tilting stainless steel vacuum pan, with integral condenser and vacuum pump, for vacuums up to 27 in.

Mixers — An improved ribbon blender in the booth of the J. H. Day Co., Cincinnati, Ohio, had fins attached to the circular ribbon which are said to cut blending time by as much as 50 percent. The new unit can employ speeds as high as 150 rpm., as compared with 60 rpm. on previous units.

Primarily for pilot plant use, the new 00 Unit Drive Simpson intensive mixer shown by National Engineering Co., Chicago, has a variable speed drive, is self-contained, can use variable muller weights and has a new type discharge mechanism. Supplied with a 1½ hp. motor, its capacity is from ¼ to ½ cu.ft. per batch.

Initially developed for use in the food field for making such products as marshmallow, the new Oakes continuous, automatic mixer was exhibited by American Machine & Foundry Co., New York. The machine is of interest in the manufacture of foam rubber but can also be used as a continuous mixer or emulsifier where gas is not incorporated in the mix. The unit comprises a cabinet containing the variable speed drive mechanism for the mixer head and for the feed pumps. External of this is the mixing head proper. The mixing head consists of a cylindrical casing containing a rotor, with projections on both rotor faces rotating between comparable projections on both internal faces of the stator. Material is fed first over one face of the rotor from center to periphery, then back to discharge at the center over the other face, after having been subjected to innumerable shearing actions.

To permit quick mixing of materials in 30-gal. or in 55-gal. drums, units of a new rocker-roll drum mixer, handling from one to four drums, were introduced by the U. S. Stoneware Co., Akron. In this unit the drum is not only rocked back and forth on its axis eight times per minute, but it is also rotated at the rate of 13 rpm. The unit can be used as a mixer, for applying protective coatings to the interior of drums or as a drum cleaner. The same concern showed a pail tumbler, especially designed to tumble 5-gal. paint cans.

Process Equipment

Details of a new multiple-effect caustic evaporator were disclosed by the Buflovak Equipment Division of Blaw-Knox Co., Buffalo. Increased simplicity and a material reduction in cost result from the incorporation of the salt separators in the bottom of the evaporator bodies, rather than in separate, external bodies. The bodies are made extra high and require no entrainment separators.

Distillation Products, Inc., Rochester, N. Y. showed its recently introduced laboratory-type centrifugal molecular still for samples up to 2½ liters. Adjustable rotor heat and feed rate permit regulation of distillation rates from 0.03 to 10 g. of distillate per minute. The unit employs the same centrifugal evaporator principle used in this company's plant scale molecular stills.

A novel adaptation of the heat pump, in the form of a low-temperature vacuum evaporator for heat-sensitive materials, was exhibited by Mojonnier Bros. Co., Chicago. The unit has already been applied on citrus juices and is now going into the biological and anti-biotic fields. All the heat is provided as electrical energy supplied to an ammonia compressor. The compressed ammonia vapor is cooled and condensed in the evaporator for the heat sensitive product, and the condensed ammonia is expanded and re-evaporated in the condenser used to maintain a vacuum on the product evaporating system. A vapor separator for the product, a secondary condenser for the ammonia vapor and an air ejector for the product condenser constitute all the remaining equipment needed. Evaporation takes place at low temperatures, for example 60 deg. F.

Separation Equipment

Dust Collectors—Its Type N Roto-clone, a large-capacity, wet-type dust collector, was shown by American Air Filter Co., Louisville, Ky. This redesigned unit provides a range from 50 to 1,200 cfm. per lineal foot of air-cleaning curtain. The wet curtain is produced by drawing the incoming air over water contained in a tank and through a specially designed orifice stretching across the tank. The moving air entrains the water and whips it violently through the orifice to produce a large surface of contact. The water is then removed by eliminator plates.

The recently developed Mikro-collector, exhibited by the Pulverizing Machinery Co., Summit, N. J., employs a large-diameter dust filter tube which is continuously cleaned by a back-blow from a slotted metal tube surrounding the filter tube, which continuously moves up and down across its surface. The effect is to give greater capacity and permit denser filter media to be employed.

Flotation—For certain applications such as rougher and bulk flotation, a new type unit shown by the Denver Equipment Co., of Denver, is effective. This unit has no cell partitions and the product overflows into a series of troughs within the shell, rather than overflowing over the side. The unit is intended primarily for rough cutting ahead of a cell-to-cell unit.

Filters—Its line of small single-element oil filters has been redesigned by the Commercial Filters Corp., Boston. This concern also has a new air filter that operates at pressures up to 250 psi. A new stainless steel pressure filter, introduced by Enzinger Union Corp., Angola, N. Y., is of the leaf type, with leaves from 30 to 48 in. in diameter. A new cylinder type disk pressure filter, shown by Ertel Engineering Corp., Kingston, N. Y., is novel in sealing the filter elements separately from the sealing of the outer lid, thus providing a positive seal on the filter elements and allowing less than the maximum number of disks to be employed.

Portable cylinder type pressure filters exhibited by the Groen Mfg. Co., Chicago, employ woven stainless steel wire cylinders and have 70 sq. ft. of capacity. A slurry tank and discharge pump are combined with the unit, which is portable. The filter can be completely turned over so that all filtrate can be recovered. Shown by the Hercules Filter Corp., Paterson, N. J., was a new carbon cartridge filter designed for use where small quantities of very pure, deodorized water are needed.

The stainless steel porous filter media produced by powder metallurgy methods by the Micro Metallic Corp., Brooklyn, were shown in several new variations including cylindrical, bayonet and star types. A new clarifier was introduced which automatically rakes a layer of filter aid from the filtering surface every time the pressure drop through the filter increases by 5 psi. The unit thus is said to give considerably longer life between shutdowns for cleaning.

Niagara Filter Corp., Buffalo, showed its new Auto-Sluice device for pressure filters, which employs water at 100 psi. and, once started, automatically sluices cake from the vertical filter leaves within the cylindrical pressure chamber for 10 to 20 min., using 70 gpm. of water. This device uses nozzles which automatically rotate and reciprocate so as to reach every part of the cake. It eliminates opening of the filter except for periodic inspection and is employed on larger filters from 160 to 500 sq.ft.

Filter plates made of Panelyte were

(*Continued on page 200*)

EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

Chairman of the Board

Dr. Vannevar Bush's resignation as chairman of the Research and Development Board of the national military establishment was to be expected in the light of his reiterated policy of rotation for that post. His belief in this sound policy is just one of the reasons why the United States people should wish Dr. Bush "God speed." In government service since 1940, Dr. Bush has consistently demonstrated his talents for leadership and administration, and his scientific ability. Much of the credit for the development of World War II's amazing scientific weapons can be credited directly to Dr. Bush's leadership. As he returns to his civilian job as president of the Carnegie Institute of Washington, we add our voice to the others saying "well done."

The successor to Dr. Bush is another able scientist, leader and administrator. Few will say there could have been a better choice than Dr. Karl T. Compton, who has so ably led the Massachusetts Institute of Technology, particularly through the confused postwar adjustment that all universities have had to face. Dr. Compton is no newcomer to government service, having an enviable record of wartime service. Under Dr. Compton science in the armed forces will continue to advance.

The armed forces have lost one leader in Dr. Bush, but they have also gained another in Dr. Compton.

Labor Power

With most companies decrying the concentration of labor unions into groups wielding tremendous economic power, it is a surprise to hear a company complain that it has not happened to the unions with which that company deals. But this seems to be just what International Harvester is doing. In their President's Quarterly Review for May to July, 1948, International Harvester says:

"In our opinion there are three causes for the large number of strikes we have had:

"(1) The multiplicity of unions with which we have relations. We now have 22 international unions and several independent unions, making a total of more than 185 union locals. Most similar companies, on the contrary, deal with only one major union, or at most, a small group. Their contract questions come up once a year. We are nearly always in negotiations with one or more unions.

"(2) Rivalries between unions. It frequently happens that the Company is placed at a disadvantage as rival unions seek to outdo one another in bargaining with us.

"(3) Irresponsibility of union leaders . . ."

The first two points cited by Harvester sound like they would rather deal with a United Auto Workers or United Mine Workers than with a multitude of unions. The industrial world has watched the growth of power in centralized unions for more than a decade, and the result has not always been a happy sight. We hate to see companies further such continued growth. We do not believe that Harvester would like it too well if they did have to deal with an industry-wide union. Perhaps there are other ways of cutting down the number of strikes Harvester had.

Flourishing Industry

Synthetic rubber production is holding its own in the battle between natural and man-made products. Although August imports of natural rubber from the Netherlands Indies were the largest since the war, GR-S consumption in August was 36 percent of total rubber consumption, the highest ratio since January 1948, and butyl consumption was over 6 percent of total, the highest since May 1947.

"Cold rubber" (the popular name for GR-S which is polymerized under 41 deg. F.) has received an enthusiastic indorsement from the domestic rubber manufacturers. Present initial production of cold rubber at one of the government plants is to be extended so that about half of all synthetic-rubber plant capacity now in operation will be equipped for the new process. Approximately a year will be required for the necessary addition of refrigerating equipment to eight plants.

Thirty percent longer mileage in tire treads has been reported on a basis of road tests. Since this refers to the best previous performance of any kind of rubber in tire treads, it is not difficult to visualize the concern with which growers of natural rubber view this latest threat by the chemical engineers. Although this country could now put its entire synthetic rubber industry on such a cold rubber basis, thereby freezing out a tremendous tonnage of natural rubber, the chemical engineers also appreciate the importance of stable international economy and friendly relations with rubber-producing countries.

Failure to Measure Up

One of the country's most distinguished educators recently referred to "the failure of engineering personnel to measure up to the physicists in the war effort." That seems to us an unwarranted criticism. It may be that some of the graduates of the particular school where the comparison was made may have been disappointing to the engineers. But we do not believe that generally there was any marked advantage of either physicist over engineer or engineer over physicist during the war period.

However, the comparison does seem to indicate a need for new orientation in our thinking. There is much loose talk about the difference between physicists and engineers, or between scientists and engineers. Let's go

back to the one fundamental difference in responsibility for a moment.

The scientist is supposed to find out what theoretically should work. The engineer takes that knowledge and makes it work on a practical scale. Neither can be fully useful without the effective work of the other. They are an inseparable pair in service to the nation and to industry. There is no sharp line marking the end of one's job and the beginning of the other's. Comparison is bad. Only cooperation is needed.

Biochemical Ingenuity

CHEMICAL engineers have done a fine job in producing large quantities of DDT in recent years. Some of us may even have relaxed a bit and surveyed our handiwork with some feeling of satisfaction. To the extent that such relaxation has occurred, we suggest that the time has come to start to work again.

Nature, in her persuasive way, has apparently developed a significant number of houseflies which are resistant to DDT. Entomologists of the U. S. Department of Agriculture state that "There is now definite evidence that houseflies are developing resistance to DDT in many parts of this country and elsewhere in the world." This observation confirms the laboratory conclusions that such biological possibilties were actually probabilities.

While we of the chemical engineering profession should not be expected to go back to college and study entomology, or related biological sciences, we should encourage our scientific associates to discover or synthesize new insecticides which can supersede DDT.

For Better Plastics

SUPPLY of plastic raw materials is growing steadily and thus creeping closer to the point of balance with demand. So reports the Plastic Materials Manufacturers Association. This reminds us that both producers and users of plastics now have a new responsibility which they should not ignore.

During the war and since, many firms have used plastic materials which were far from adequate for the purpose to be served. In periods of scarcity that is inevitable with any commodity. The time is now approaching when buyers need no longer take anything they can get. They rightly may, and doubtless will, be much more choosey in their specifications and plans for purchasing. This is a good thing.

But it also imposes a new responsibility on both parties. It means that users must more accurately define their needs, both in general language and in improved purchase specifications. Comparable advance by materials manufacturers will, of course, be a necessary companion movement. For the good name of the plastics industry, it is essential we not only produce the best possible products, but see that they are properly used.

An Unjustified "Right"

WE QUOTE from a recent report published by the Naval Ordnance Laboratory which says: " . . . the Navy's Patent Policy permits the employee to retain the commercial rights to his invention (security permitting), and gives him a sound patent free of all costs. This practice is in contrast with that in force at all industrial and most governmental laboratories where the employee surrenders to his employer all rights to his invention."

If this principle is to be applied broadly by the Navy, then the taxpayer pays twice when once should be enough. He pays the research man for doing the work. Then he pays in royalty charges for private exploitation by the government worker of inventions which already belong to the public by all moral and legal principles.

Those who undertake to defend this policy claim that the Navy workers are underpaid. Thus, they argue, this private profit from patents is necessary to keep good men in the Naval services. We doubt whether these statements are true. If they are, the remedy is to increase the salaries to the proper level for all competent workers. It is not a proper remedy to circumvent Congressional definition of salary scales by this indirect system of private profit on public property.

Long ago the civilian career agencies of the government began to do away with these subsidies to research men. It is high time that the military services do likewise.

New Traffic Problems

CHEMICAL engineers in choosing plant sites and arranging for layout of facilities have long given careful thought to rail traffic. Now the problems of automotive traffic are of equal or greater importance. They are too often neglected.

There are several parts of this new job of traffic planning. One which is most space consuming is the job of arranging for entrance, parking, and the exit of large number of employee cars. A plant site not readily accessible for workers and providing too little parking space is bad from the standpoint of employee relations.

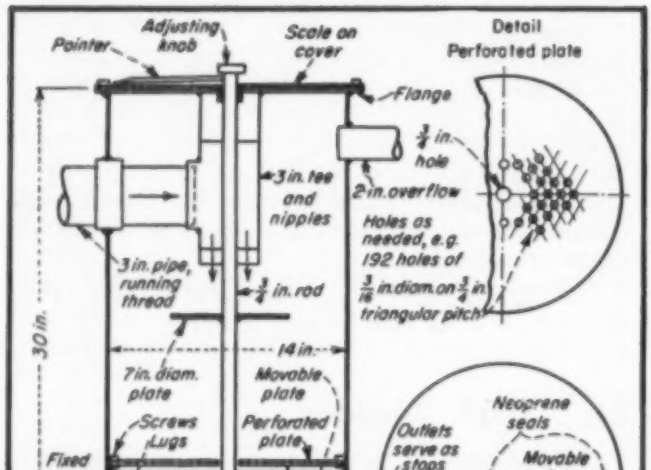
Equally important, though less space consuming, is the problem of visitor traffic, not forgetting both suppliers' salesmen and important customers. These folks should be able to reach a strategic spot and leave their cars conveniently. Unless they can, they arrive at conferences all steamed up, both literally and figuratively. Outside relations are much improved by planning for convenience of physical access. This is just as important as the well-recognized need for courteous and prompt telephone service in the interest of good public relations.

And the truck problem is a growing and constantly more difficult feature. Far too many establishments have taken it for granted that the public highways can be used for deliveries and shipping. The day has long since passed when this is a safe assumption, even in suburban and rural areas. The personnel hazard and the cost for protection of general traffic and passers-by no longer make street-side operation economical.

In general, management in the process industries must face all of these problems. The workers must get in and out quickly for they are paid almost from the moment they step out of their cars. Management must make sure that the logistics (as our military friends put it) are sound for goods incoming and outgoing. The over-all cost of neglect is too great to be ignored by chemical engineers even though details of the job and its over-all responsibilities may rest with others in management.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR



Reflux-Product Splitter for Condensate Streams Containing Water

MELVIN NORD
Nord & Co., Keyport, N. J.

September Contest Prize Winner

A SIMPLE reflux splitter for dividing the condensate stream from a distilling column into reflux and product streams is described here. This splitter is particularly useful when the condensate stream contains some water, as in distillation with open steam. The water is decanted before the splitter, but this decantation is not always perfect. In such a case, the water tends to collect in the bottom of horizontal pipes (if the product is lighter than water; otherwise, vice versa), and is not generally distributed uniformly even after leaving horizontal pipes or fittings to enter vertical pipes. This tends to cause an improper split of the non-aqueous phase. The splitter described below is designed to avoid this difficulty .

Essentially the splitter is vertical cylinder containing a horizontal perforated plate. The perforated plate is designed to hold back an appreciable depth of liquid so that there will be adequate time for even distribution of water and so that the flow itself will be evenly distributed across the cross-section of the cylinder. Beneath the perforated plate are two vertical solid plates, one fixed and the other movable. Both plates are fixed radially in the cylinder. The movable plate is attached to a vertical rod which extends through the top of the cylinder. A pointer and an adjusting knob are attached to the top of the rod. As the pointer is moved, it indicates the position of the movable plate on a scale which is calibrated in terms of reflux ratio.

Two outlets are provided at the bottom of the cylinder (one on each side of the fixed plate), each outlet pipe projecting slightly above the bottom of the cylinder to act at stops for the movable plate. Setting the movable plate in a given position divides the cross-section of the cylinder into two sectors, as indicated in the accompanying figure. The outlet pipe leading to the reflux accumulator drains one sector and the outlet pipe leading to the product receiver drains the other sector.

These outlet pipes must be large enough to prevent flooding of the part of the cylinder below the perforated plate. Neoprene wipers are attached to the bottom and edge of the movable plate and to the edge of the fixed plate which is adjacent to the center rod, so as to eliminate leakage from one sector to the other. A foot bearing at the bottom of the cylinder and a bushing at the top of the cylinder keep the center rod aligned.

If the flow rate drops well below the normal value, so that the depth of liquid retained on the plate becomes small, an additional distributing effect is provided by a solid disk attached to the center rod some distance above the horizontal plate. The entering pipe is turned down so that the stream impinges directly upon the center of the disk. If the flow rate rises well above the normal value, the section above the perforated plate floods above the disk, but this does not affect the split. An overflow pipe is provided near the top of the cylinder to take away any surges which cannot be handled by the splitter. A sight glass should be fitted in the line leading away from this overflow connection to indicate flooding of the splitter. A removal flange at the top permits inspection and cleaning of the splitter.

The accompanying sketch illustrates a splitter whose rated capacity is 4,000 gal. per hr. of condensate. It overflows at a sustained overload of 50 percent, and operates satisfactorily at sustained rates of about 25 percent of rated capacity. The design is very simple and is easily adapted to any capacity. A particular splitter can be changed in capacity by a substantial factor merely by taking out the perforated plate (which is held in position by bolts) and replacing it with another plate containing more or less holes, as desired. The area of holes required in the perforated plate can be calculated by the ordinary orifice formula.

How to Pour Dustlessly From Bags

A SIMPLE IDEA that may be new to many people is portrayed by a poster put out recently by the National Safety Council. When dusty material is being poured from a bag, smoother and less dusty flow is attained if air is admitted through a cut in the upper end of the bag. The principle is the same as the improvement in flow from a bottle when air is admitted through a tube above the liquid level.

$50 Cash Prize For a Good Idea!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month; e. g., the November winner will be announced in December and his article published in January. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

Removing Salt Encrustation From Nozzles of Cooling Towers

DAVID B. DUKELOW
Kansas City, Mo.

ALTHOUGH this problem may not be a common one, its solution should be valuable in a number of cases. It has proved to be an easy and effective method of preventing the build-up of salt encrustations on cooling tower nozzles where a strong brine is being sprayed instead of water.

It was found when such a brine was being sprayed that a deposit of salt formed on the outside of the nozzles to the extent that the flow was practically stopped. This encrustation could be removed periodically by hand, but this required a man to go up on the tower every two or three hours and attend to each nozzle.

By passing a very small amount of water over the outside of the nozzle, the formation of the deposit was prevented completely. It was found that a simple way to provide this fresh water to the nozzles was to run a ¼-in. pipe to a point about ¼ in. above each nozzle.

Still More on Temperature Conversion

EMILIO LEONARZ, JR.
Special Studies Engineer
The Mexican Light & Power Co., Ltd.
Mexico City, Mexico

IN BOTH the July and October issues of the Plant Notebook, articles were published dealing with "mental methods" for converting temperatures from Fahrenheit to Centigrade, and vice versa. I should like to add one more method which is based on the fact that the two scales coincide at −40 deg. Because of their symmetry I find the two formulas given below easier to remember than others for the purpose:

$$\text{Deg. C.} = (F + 40)5/9 - 40 \quad (1)$$

$$\text{Deg. F.} = (C + 40)9/5 - 40 \quad (2)$$

Here are some examples: (1) 212 deg. F. = ? deg. C. By Eq. (1), 212 + 40 = 252; 252/9 = 28; 28 × 5 = 140; 140 − 40 = 100 deg. C. (2) 154 deg. F. = ? deg. C. By Eq. (1) 154 + 40 = 194; 194/9 = 21.56; 21.56 × 5 = 107.8; 107.8 − 40 = 67.8 deg. C. (3) 100 deg. C. = ? deg. F. By Eq. (2) 100 + 40 = 140; 140/5 = 28; 28 × 9 = 252; 252 − 40 = 212 deg. F. (4) 67 deg. C. = ? deg. F. By Eq. (2) 67 + 40 = 107; 107/5 = 21.4; 21.4 × 9 = 192.6; 192.6 −40 = 152.6 deg. F.

October Prize Winner

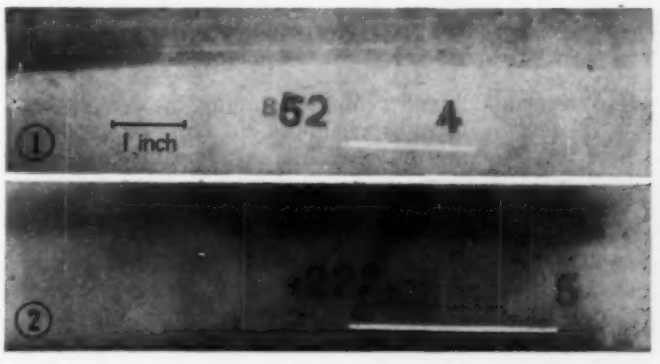
A $50 prize will be issued to

Stanley Yokell

Chemical Engineer, Union, N. J.

For an article describing a simple way of making a sump pump of pipe fittings for emergency use, for example, to take care of a plugged sewer line while repairs are being made. It has been chosen winner of the October contest.

This article will appear in our December issue. Watch for it and the other handy ideas in the Plant Notebook!



Weld Inspection by Combining Both Supersonic and X-Ray Methods

HERBERT R. ISENBURGER
St. John X-Ray Laboratory
Califon, N. J.

IN RECENT YEARS much has been written about both the supersonic and the radiographic methods of weld testing. Both have their advantages, as well as their shortcomings. Supersonic testing is faster and cheaper than radiography, but gives less reliable results. Applied together the two methods tend to give as excellent results as could be expected. This is best illustrated by a discussion of some actual experiences.

The problem was the examination of some 650 lin. ft. of butt-welded longitudinal and girth seams, in 16 pressure containers about 9 ft. long, with an outside diameter of 7½ ft. The wall thickness was ¼ in. and the material,

low carbon steel. All welds were tested by the supersonic method, and the results were marked on blueprints for each container.

Upon completion of the supersonic inspection, the most defective portions of the welds were singled out for radiographic check. Altogether about 10 percent of the welded seams had to be radiographed.

Of this amount about 20 percent showed a continuous lack of fusion throughout the length of the film (10 in.), whereas the supersonic test indicated the longest continuous defect to be but 3 in. A typical illustration of this is shown in Fig. 1 where the supersonic test picked out a 2-in. section between 52½ and 54½, but the defect is clearly visible for the full 10 in. of the film.

On the other hand, Fig. 2 depicts the supersonic findings from 222 to 225, a distance of 3 in., while the radiograph shows but a few blowholes between 218 and 219, otherwise a perfectly sound weld. About 10 percent of the sections radiographed showed only minor defects, or no defects at all, where the supersonic method indicated serious voids.

Thus it appears proper to check any large irregularity showing on the supersonic screen by a radiographic exposure, in order to make sure that (1) a serious defect exists, and (2) what kind of defect it is. Like other nondestructive methods, except radiography, the supersonic one gives only an indication that something may be wrong but it does not show what the irregularities mean. For this we have to resort to X-rays or radium. Both methods supplement each other and assure good results at a minimum of expense and loss of time.

Simplified Equations for Solution of Countercurrent Washing Problems

W. H. CUNDIFF
Technical Director, Permanente Metals Corp.
Baton Rouge Works, Baton Rouge, La.

COUNTERCURRENT decantation washing is an operation frequently used by chemical engineers in processes where the separation of solids from accompanying solvent-rich liquors is desired.

To design a countercurrent washing system it is necessary for the engineer to assemble data on the settling properties of the material involved and, by means of these data and other pertinent information, to set up a series of equations to be solved simultaneously for a number of unknowns. In these calculations there is always one equation and one unknown for each step in the washing system. When the number of washing steps exceeds two or three, as the need for efficiency often dictates, the solution of the simultaneous equations becomes a tedious and burdensome chore. This article offers a method of determining the desired values by direct substitution of known values into a number of equations which have already been solved simultaneously for the general condition.

The two most important unknowns in a proposed countercurrent washing system are the concentration of solute in the underflow from the last washing step, and the solute concentration in the overflow from the first step. Once these values are known the solute recovery efficiency is quickly available. The equations below give these quantities as well as the percent solute recovery.

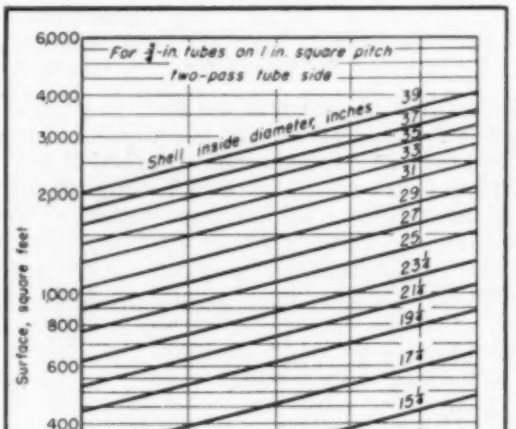
Where A = percent solute in the feed slurry liquor; B = percent solute in the strong liquor overflow; F = percent solute in the underflow of washed solids; G = percent solute in the wash water; w = pounds of wash water per pound of liquor in the underflow at each step; y = pounds of liquor per pound of dry solids in the underflow at each step; z = pounds of feed liquor per pound of dry solids in the feed; and n = the number of washing steps, then:

$$F = \frac{A + G\,(w^n y/z + w^{n-1} \ldots\ldots + w)}{(w^n y/z + w^{n-1} \ldots\ldots + w + 1)}$$

$$B = F + (F - G)\,(w^{n-1} \ldots\ldots + w)$$

$$\text{and percent solute recovery} = 100 - \frac{100y\,(F - G)}{Az}$$

(*Editor's Note:* These equations were determined by setting up the material balance equations for five washing steps and solving them simultaneously to eliminate unknowns, finally expressing the results for the general case of n washing steps. The derivation, which is relatively complex, has been omitted for lack of space but can be secured by anyone interested upon application to the Plant Notebook Editor.)



Rapid Method for the Estimation of Exchanger Bundle Sizes

WILLIAM C. SOUDRIETTE
Chemical Engineer, Cities Service Oil Co.
East Chicago, Ind.

ENGINEERS in process plants are frequently required to make quick estimates of exchanger bundle sizes and this information is ordinarily obtained from tube count sheets. Usually it is necessary to make several trials before arriving at a correct solution.

The accompanying chart illustrates a graphical method of presenting these data for easy use. It is constructed by plotting the surface area as the ordinate on regular logarithmic scale and the tube length as the abscissa on an expanded logarithmic scale. The parameter for each set is the shell inside diameter.

Each plot presents data for a given tube size, pitch, and tube side pass arrangement. Because most plants tend to standardize on tube size and pitch, the number of charts required may be only two or three. Construction is easily simplified by calculating one line and paralleling this with the other remaining lines calculated from one point each.

THESE TROUBLEMAKERS ARE NOTHING BUT A *Memory*

IN PLANTS USING THE....

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE

These users tell why it is so—

A Steel Corporation says—

"We installed a 1¼" Type '1000' reducing valve in service July 20, 1945 on 200 lb. steam pressure at 700 deg. There has been NO CAUSE FOR MAINTENANCE up to the present."

A Municipal Light & Water Plant writes—

"We use the Streamline '1000' valves on our air lines reducing air from 1000 lb. to 500 lb. to 100 lb. VERY SATISFACTORY."

A Cast Iron Pipe Company writes—

"We have in service several 1½", ¾", and ½" CASH STANDARD '1000' valves. They are used for reducing propane gas, air, and core oil. They have been in service for periods from 6 months to 5 years. These valves have required NO MAINTENANCE and to the best of our knowledge HAVE SERVED SATISFACTORILY."

A Pipe Line Company says—

"We have been using 1" x 1¼" CASH STANDARD Type '1000' valves in natural gas service—one since 1932 and 10 since 1940 and have NOT YET HAD TO REPLACE A VALVE OR SEAT."

A Manufacturer says—

"We have installed CASH STANDARD '1000' Pressure Reducing Valves in locations where other types gave constant trouble. When installed they were adjusted and since then WE HAVE PRACTICALLY FORGOTTEN THEM due to DEPENDABILITY. As a result of this experience WE SPECIFY THE '1000' FOR ALL NEW INSTALLATIONS."

1. Maximum capacity when needed most
2. Accurate pressure control under toughest working conditions
3. Trouble-free service.
4. Smooth operation.
5. Tight closure.
6. Speedier production results.
7. Elimination of failures.
8. Cost-saving operation.
9. No spoilage.
10. Practically zero in maintenance.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

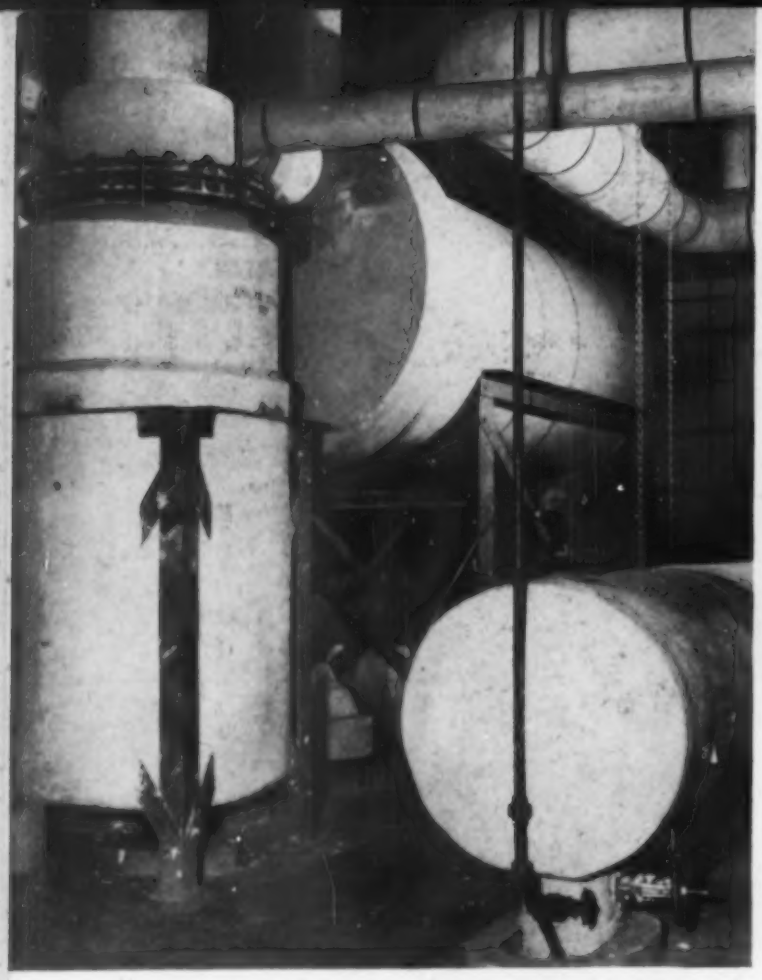
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

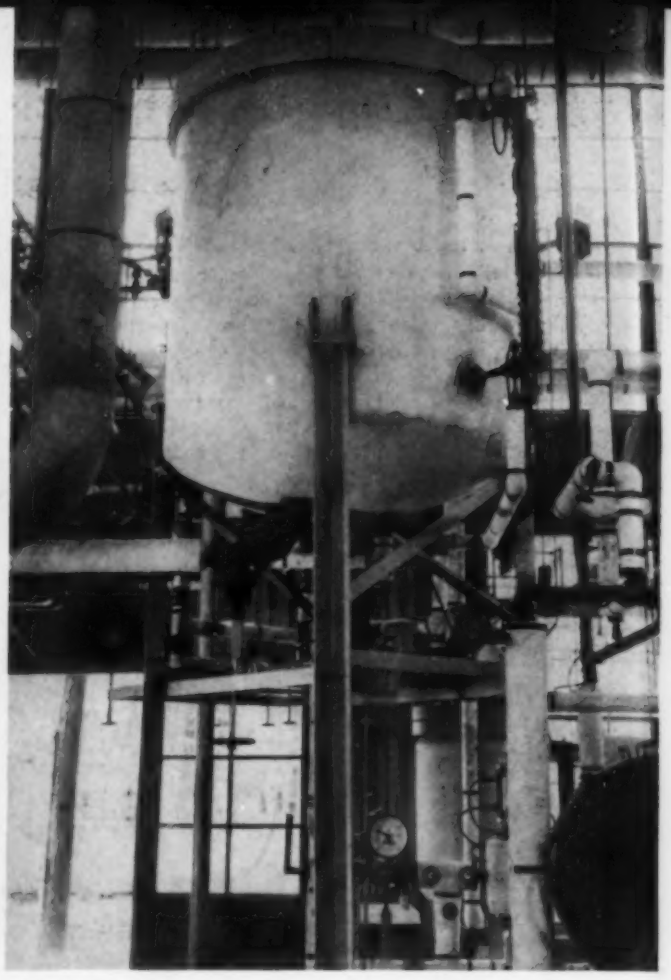
Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



1 Hydroabietyl alcohol is made from Abalyn and hydrogen. The rosin ester is shown being refined.



2 Abalyn is pumped at 90 deg. F. from storage to feed tank. Temperature is kept constant by regulator valve.

Hydroabietyl Alcohol

(ARTICLE ON PAGE 129)

HYDROABIETYL ALCOHOL is a new rosin derivative that may prove to be valuable as an intermediate in making resins, foamers, detergents, antioxidants and many other chemical products. It is produced in the Burlington, N. J. plant of the Hercules Powder Co.

This resin alcohol is made from the rosin ester, Abalyn, another Hercules product, and hydrogen. The Abalyn is pumped at 90 deg. F. to feed tanks in the alcohol unit. From storage it passes through an integrating meter to Aldrich pumps which increase the pressure.

The hydrogen and Abalyn are brought together in a mixing block. The mixture goes to a preheater, a coil with liquid Dowtherm around it. After the temperature of the mixture is raised almost to the reaction point the mixture passes to the Abalyn feed header, a line connecting all reactors. A second preheater, immediately following the first, is used for making final adjustments in the temperature. The mixture then enters the bottom of the reactors.

Reactors are tall forged, type 304 stainless steel vessels. Each one is located in a concrete barricade. The closure on the top and bottom of the reactors is interesting. The seat is on the side of the reactor. The head moves with respect to the retaining flange which forces the copper gasket outward against the reactor walls so that greater pressure means less opportunity for leaks.

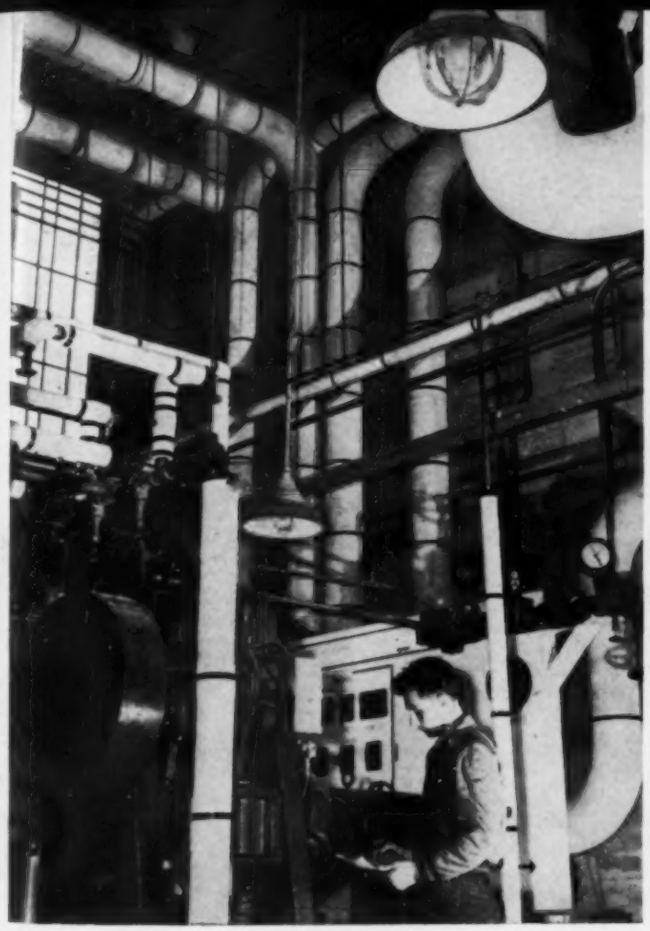
Under normal operation two reactors are used in progressive series, A and B, B and C, C and A, and so forth, with the second reactor in each case containing the fresh catalyst. The reactor that is not in operation is being emptied and recharged. The control is done by laboratory analyses which are made hourly in order to determine percent purity of product.

When leaving the second of the two reactors the products pass to a high-pressure separator located in a concrete barricade. Here the excess hydrogen gas is removed through a back-pressure valve which maintains the required high-pressure in the system.

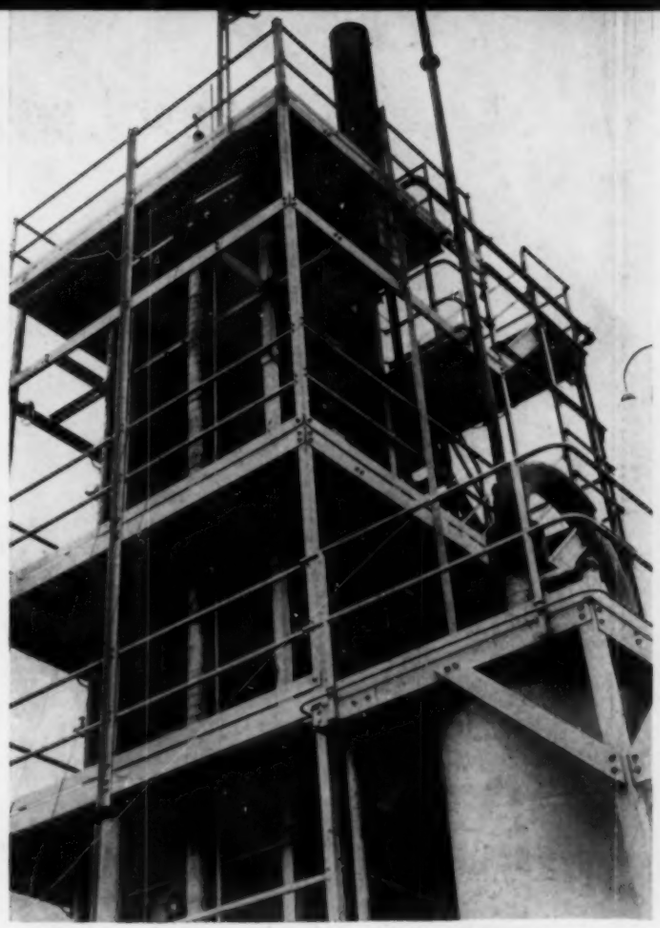
From the bottom of the separator the liquid product is blown off through a regulating valve operated from the weight of the high-pressure separator. The gas is purged off into the air. The liquid product, which is saturated with hydrogen and methanol, passes to the low-pressure separator maintained at 10-lb. pressure.

The hydrogen and methanol are flashed off leaving the product. From here the hydroabietyl alcohol goes to the cooler and then through the Fullflow filter. The product is then stored or put into drums.

CHEMICAL ENGINEERING
November 1948
PAGES *158-161*

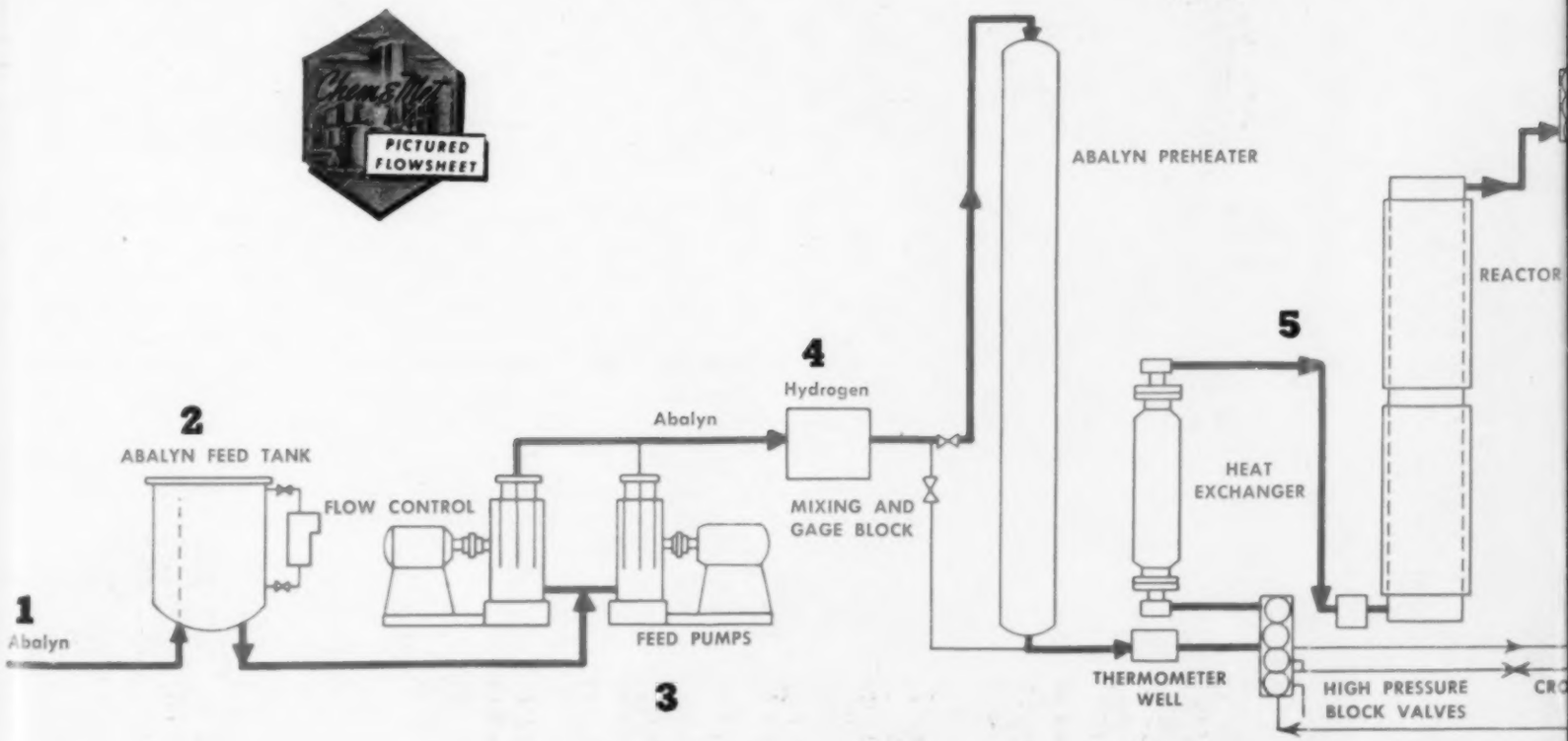


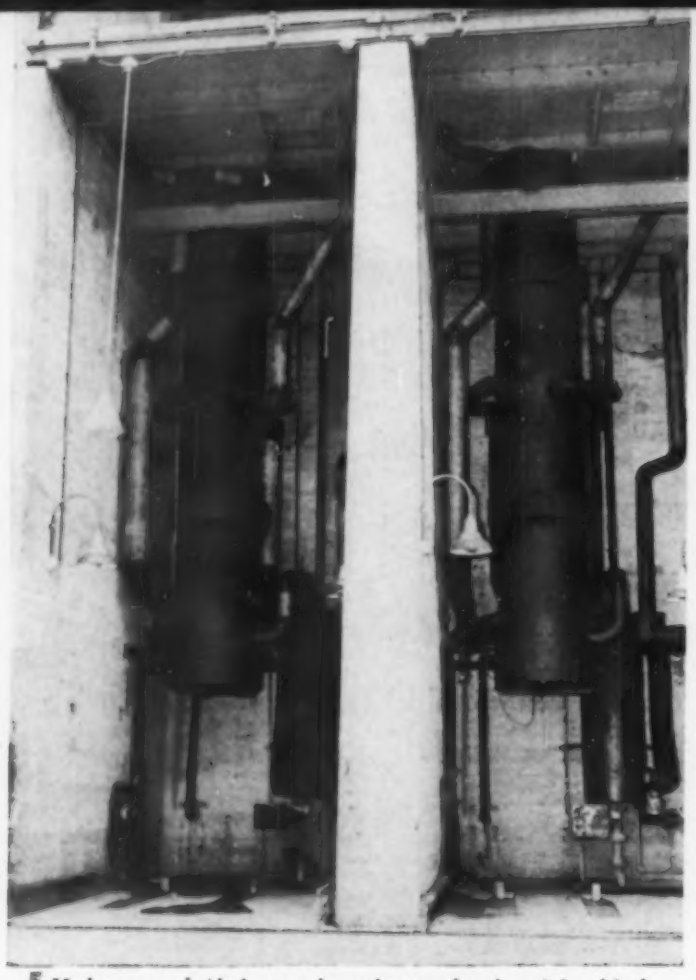
3 From the feed tank Abalyn goes through an integrating meter to feed pumps which increase pressure.



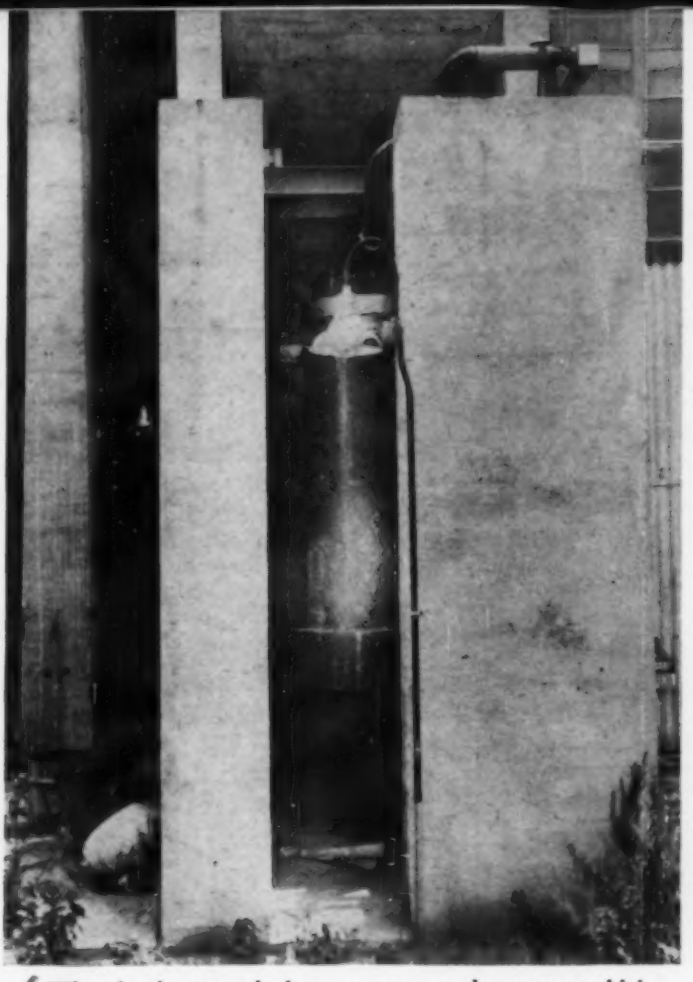
4 Hydrogen, the other raw material for alcohol production, is made from propane in this cracking furnace.

5 Hydrogen an
preheated, and p

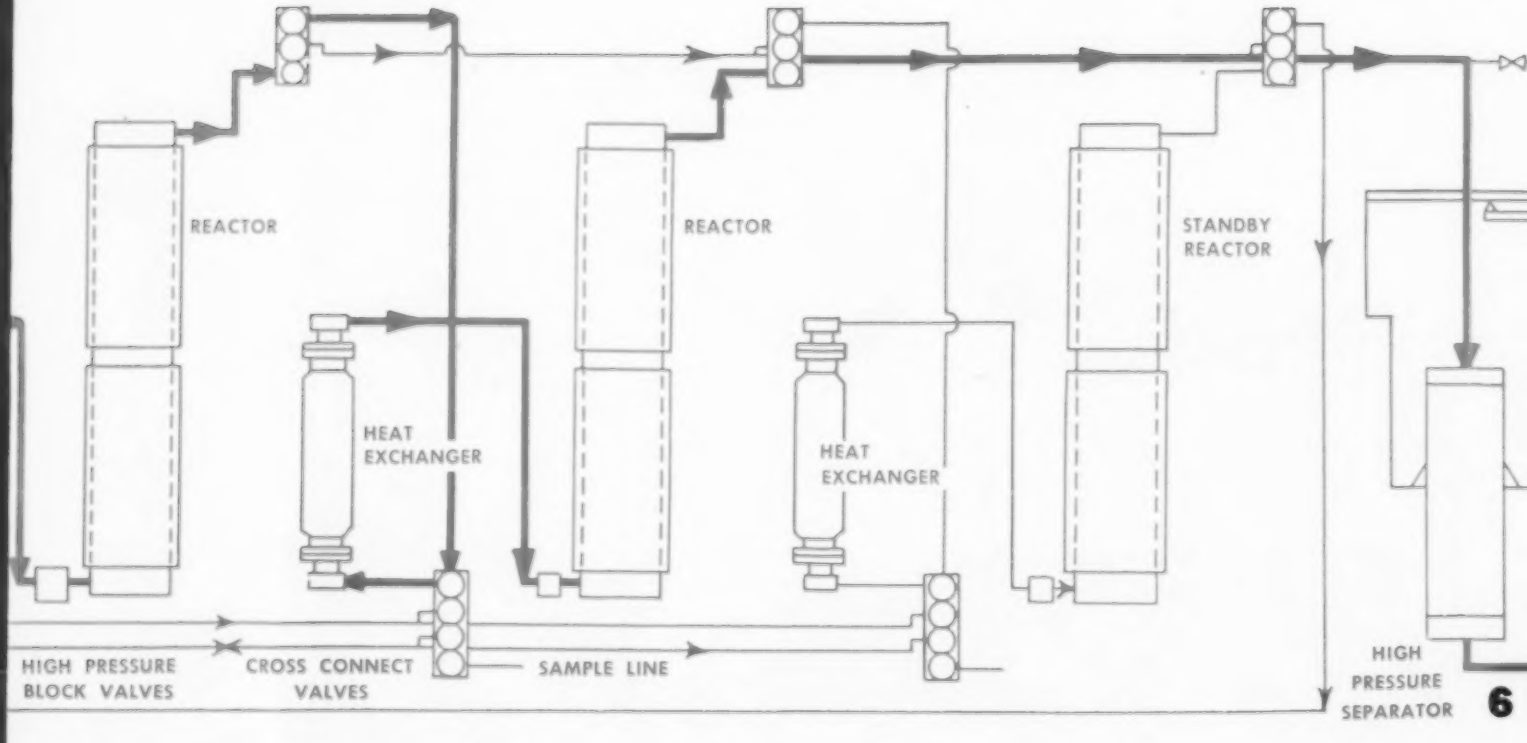




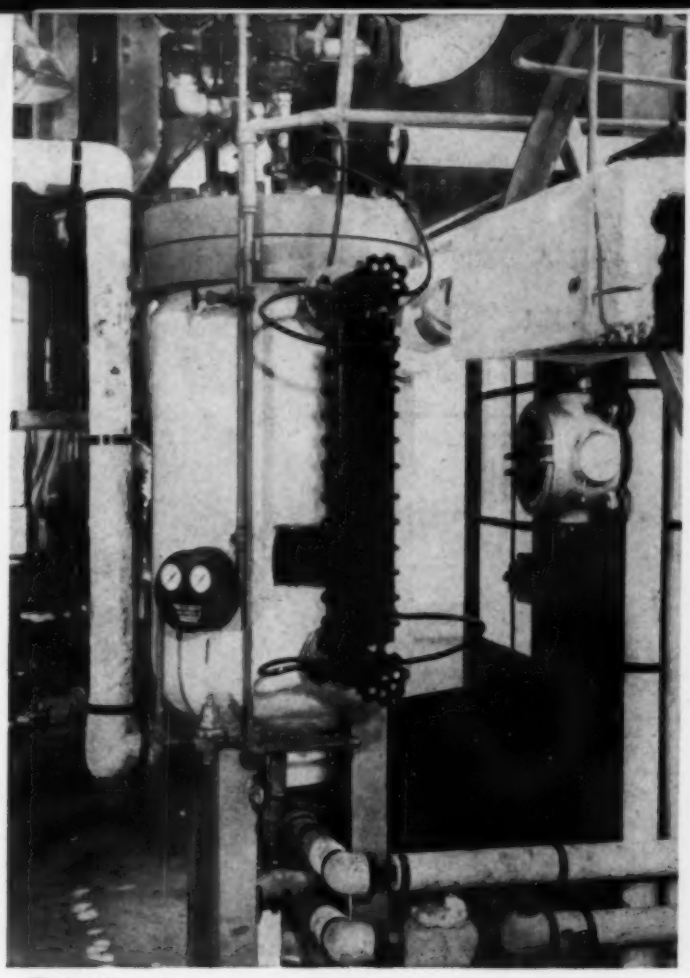
5 Hydrogen and Abalyn are brought together in mixing block, preheated, and passed to stainless steel reactors.



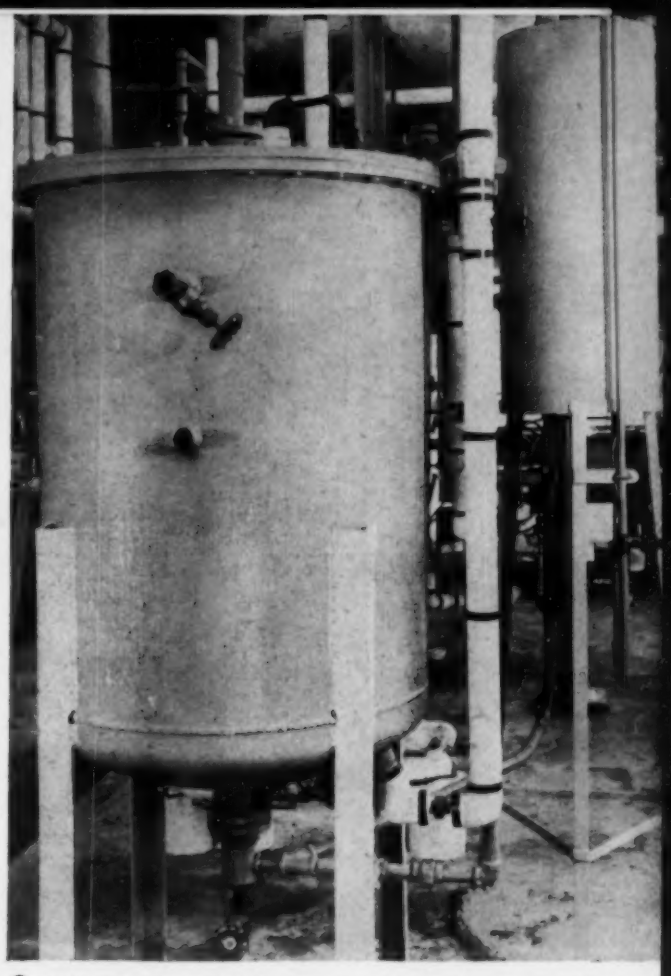
6 When leaving second of two reactors products pass to high-pressure separator for separation of products from off gases.



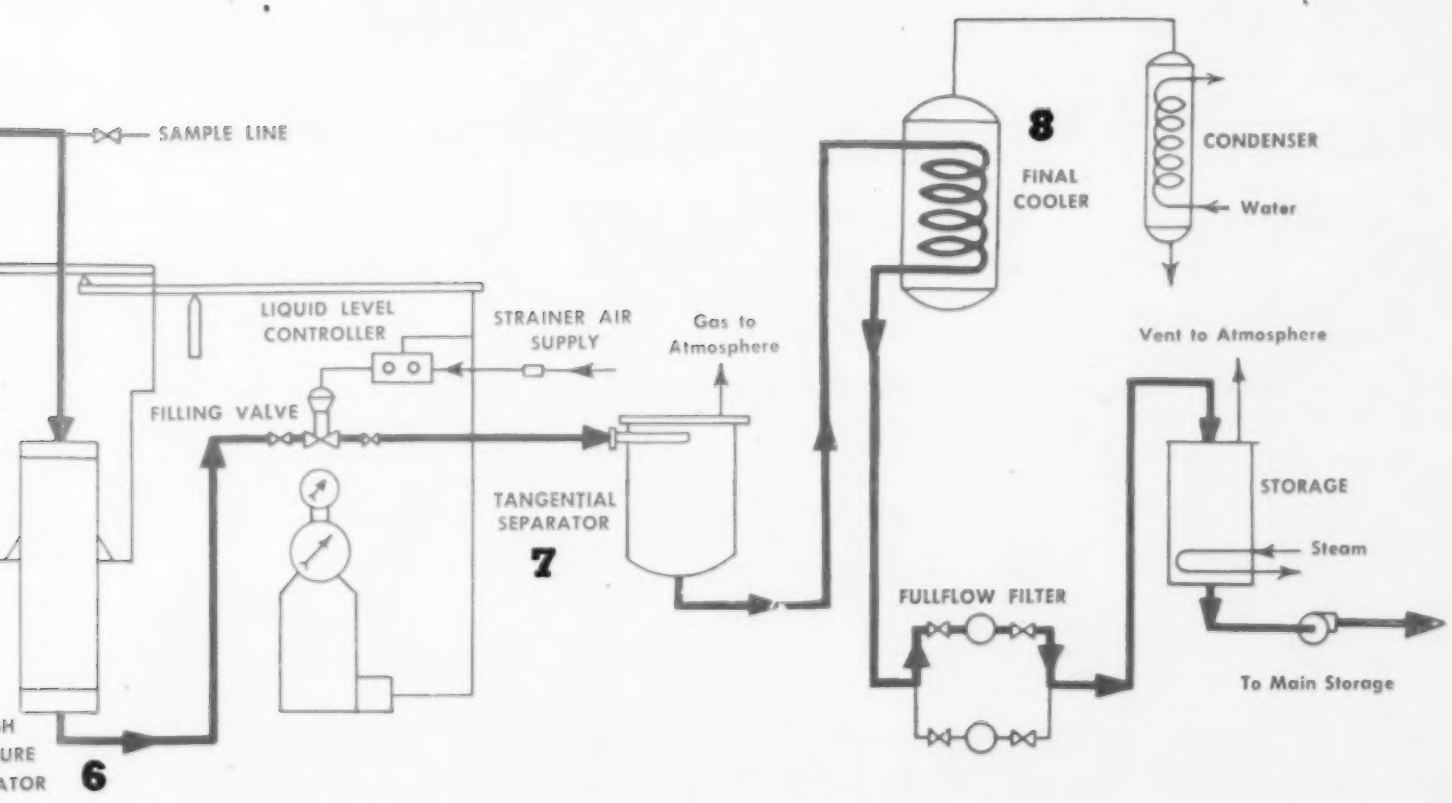
to high-
gases.



7 Liquid product passes to low-pressure separator where hydrogen and methanol are flashed off leaving the product.



8 Hydroabietyl alcohol then goes to the cooler shown, then through the filter, and to storage.



ALLIS-CHALMERS "Certified" Service

A BREAKDOWN on this 39-year-old Allis-Chalmers fan motor crippled operations at the plant of an important midwest electric utility. Immediate repair was vital. The Chief Engineer called the nearest Allis-Chalmers Certified Service shop. They picked up the rotor and returned it ready for service in less than twenty-four hours.

This is the kind of emergency cooperation you can expect from every Allis-Chalmers Certified Service shop. On everyday repairs and maintenance too, your Allis-Chalmers Certified Service shop will give you prompt service on Allis-Chalmers motors, pumps and transformers, using factory approved methods and parts. Every Allis-Chalmers Certified Service shop has been selected for skilled, personal, careful workmanship, adequate equipment and *service mindedness.*

HOW TO FIND NEAREST SERVICE SHOP

Allis-Chalmers Certified Service shops are located in major industrial centers throughout the country. New shops are being appointed continuously and most smaller centers will soon be covered. To find the shop nearest you, call your closest Allis-Chalmers District Office. A 2343

MOTOR DELIVERIES GREATLY IMPROVED

Many types of Allis-Chalmers Motors are now in stock! Many other types are available on short delivery! For motors from 1 to 200 HP, check your nearest Allis-Chalmers Authorized Dealer. For motors larger than 200 HP, check with the nearest District Office. You may be able to get what you need sooner than you think.

ALLIS-CHALMERS, 1147A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

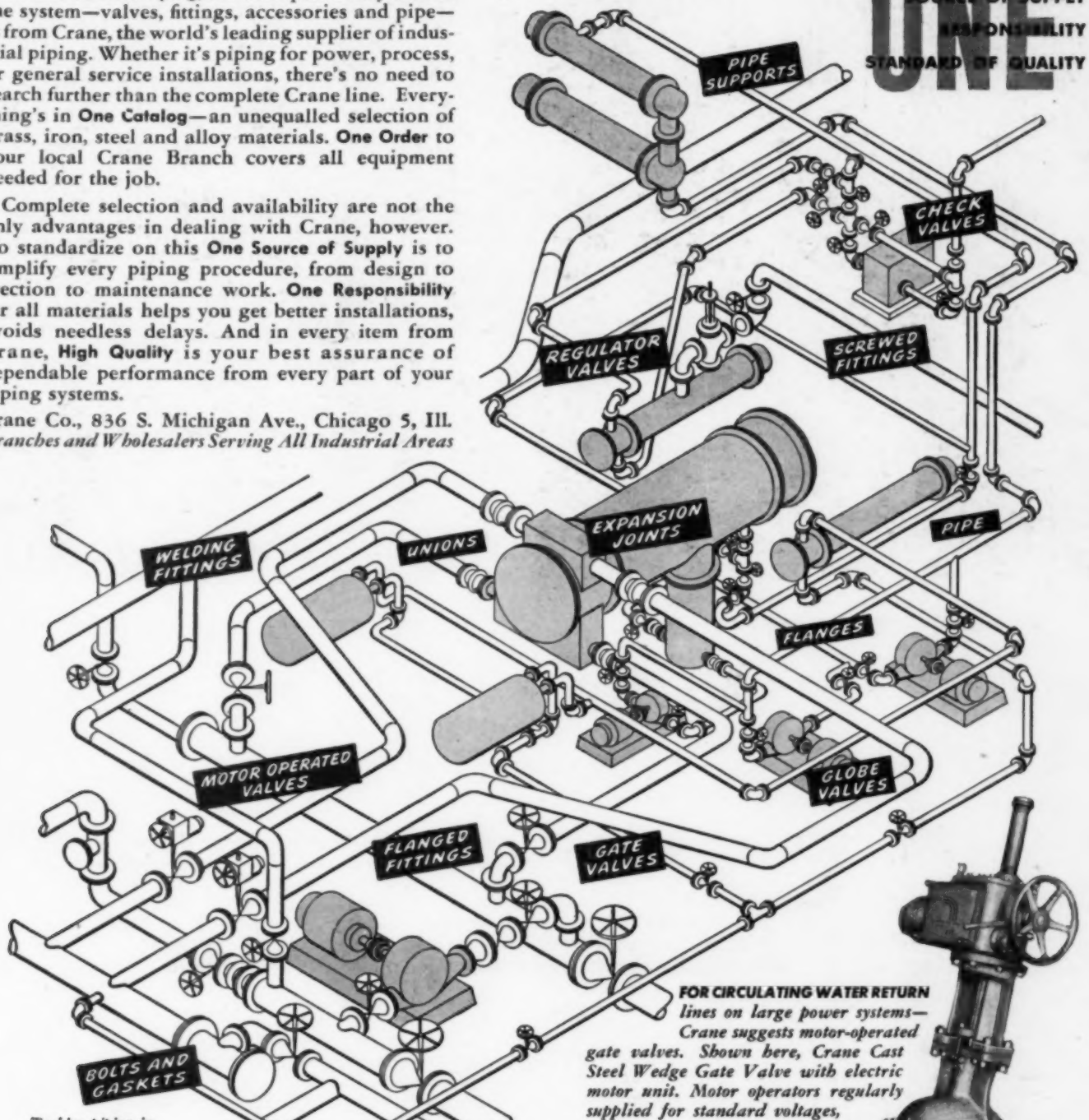
Everything in power piping ...on One Order to Crane

Take This Turbine Piping, for example. Every item in the system—valves, fittings, accessories and pipe—is from Crane, the world's leading supplier of industrial piping. Whether it's piping for power, process, or general service installations, there's no need to search further than the complete Crane line. Everything's in **One Catalog**—an unequalled selection of brass, iron, steel and alloy materials. **One Order** to your local Crane Branch covers all equipment needed for the job.

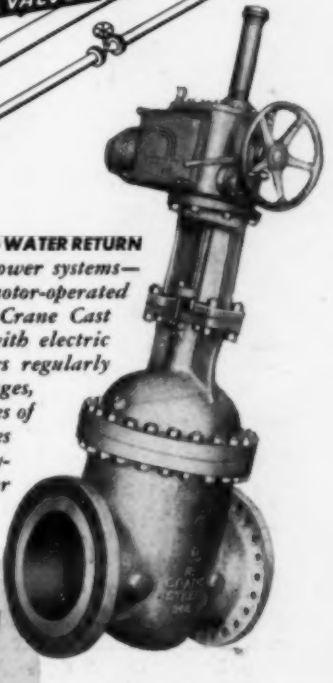
Complete selection and availability are not the only advantages in dealing with Crane, however. To standardize on this **One Source of Supply** is to simplify every piping procedure, from design to erection to maintenance work. **One Responsibility** for all materials helps you get better installations, avoids needless delays. And in every item from Crane, **High Quality** is your best assurance of dependable performance from every part of your piping systems.

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Turbine piping in large power plant.



FOR CIRCULATING WATER RETURN *lines on large power systems—Crane suggests motor-operated gate valves. Shown here, Crane Cast Steel Wedge Gate Valve with electric motor unit. Motor operators regularly supplied for standard voltages, either AC or DC for all types of valves. Crane also furnishes other types of operators—hydraulic, air, etc. See your Crane Catalog.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

It's double economy

TO DRY AS YOU GRIND

RAYMOND

IMP MILL with Flash Drying System

IMP MILL with furnace unit for supplying heated air to the mill system.

SINCE 1887

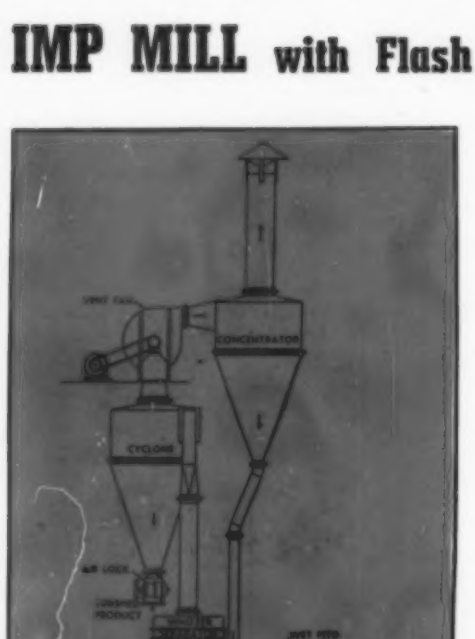


Diagram of IMP MILL with flash drying equipment for removing moisture while pulverizing.

WHENEVER your pulverizing process involves the removal of moisture, you can do both operations at once in the same mill at big savings in production costs.

The Raymond IMP MILL with *flash drying system* is specially designed for this purpose. It can handle materials containing high percentages of moisture as, for example, acid treated clays which come from the filter press with as much as 60% moisture content. In this pulverizing process, the moisture is reduced below 6% and the finished material delivered at a fineness of 96% minus 200-mesh.

This method is economical in drying and grinding chemicals, diatomaceous earth, resins and a great number of specialty products. *Write for further details . . . and state your problem.*

COMBUSTION ENGINEERING COMPANY, INC.

RAYMOND PULVERIZER DIVISION

1311 North Branch Street — **Chicago 22, Illinois**

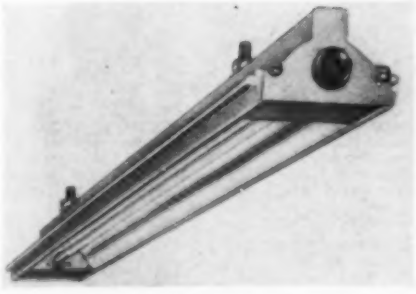
Sales Offices in principal Cities — Canada: Combustion Engineering Corp., Ltd., Montreal

PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

CONTENTS

Metal Radiant Heater....165
Adjustable Sheave....165
Connector Panel....165
Flowsheet Templates....166
Double Drum Dryer....166
Waterfog Fire Control System....166
Equipment Cost Indexes....166
Vibratory Elevator....166
Electronic Air Filter....168
Waste Treater....168
Flowmeter Tube....168
Cooling Coil....168
Magnetic Pulley....170
Paste Mixer....170
Ultrasonic Gage....170
Compact Spray Dryer....172
Vacuum Indicator....174
Check Valve....174
Irregular Grinding Balls....176
Liquid Plastic Coating....176
Straight-Through Valve....176
Small Continuous Vacuum Filter....176
Automatic Label Coder....178
Self-Powered Telephone....178
Small Tube Cleaner....178
Preformed Pipe-Fitting Covers....178



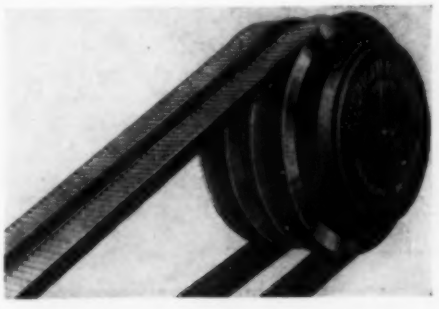
1. Metal Radiant Heater

NO GLASS is used in a new type of all-metal electric radiant heater for industrial drying, baking and preheating applications which has been announced by Edwin L. Wiegand Co., 7500 Thomas Boulevard, Pittsburgh 8, Pa. As the illustration shows, the new unit is of strip type, being made in over-all lengths ranging from 24¾ to 47 in., with heating unit lengths from 17 to 39 in. The units are approximately 4 in. wide and are provided on the edges with a hinge type tongue and groove joint.

The high temperature inclosed type Chromalox heating unit is mounted in a rigid, extruded aluminum body with an efficient reflector sheet of polished Alzaked aluminum. A negligible amount of visible light is produced from the Inconel-sheathed tubular heating element which operates at temperatures from 1,000 to 1,400 deg. F., depending on the wattage. The unit produces the longer wavelengths of infra-red radiation which are said to be absorbed almost equally well by surfaces of all types.

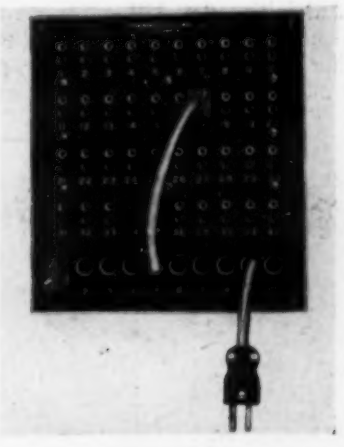
Owing to the tongue and groove construction, adjacent sections can be interlocked on a plane or can be rotated up to 25 deg. for supporting multiple units in a wide variety of patterns. Simple angle-iron frames can be formed to support the assemblies.

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182



2. Adjustable Sheave

PERMANENT adjustability, without the danger of the adjusting mechanism freezing, is claimed for a new wide-range, adjustable-diameter drive offered by the American Pulley Co., 4200 Wissahickon Ave., Philadelphia 29, Pa. The new construction feature of this sheave is the rubber-lagged hub upon which the sheave flanges are mounted. Bonded to the steel hub of the sheave, the rubber section eliminates freezing by acting as an insulating cushion between the flanges and the hub. The unit is said to be permanently quiet and to be dynamically balanced. The adjusting mechanism provides a positive means of shifting all flanges simultaneously, a single locking screw preventing flange movement while the sheave is in operation. These sheaves are made in two- and three-groove patterns, with pitch diameter variation of 5.25 to 10.0 in. Load capacity is up to 15 hp. The sheaves utilize multiple "R" section V-belts.



3. Connector Panel

DESIGNED to provide a quick and flexible method for connecting any thermocouple of a group to any position on multiple recorders or indicating and controlling pyrometers, a new thermocouple connector panel has recently been developed by the Thermo Electric Co., Fair Lawn, N. J. The panel, designed for flush mounting, is available in various combinations, with any desired number of plugs and jacks. The plugs and jacks are polarized and

made of thermocouple materials for all standard calibrations. It is claimed that the positive spring jacks firmly hold the plugs and maintain perfect contact at all times. To facilitate any desired hook-up, the positions are numbered on both front and back of the panel.

4. Flowsheet Templates

To FACILITATE the production of piping and process diagrams and flowsheets through the use of standard symbols, Timely Products Co., Box 206, Columbus 9, Ohio, has introduced two transparent plastic templates which are accompanied by an instruction manual. Included are symbols for several sizes of vessel heads and nozzles, symbols for valves of all common types, instruments, pumps, fans, blowers, ejectors and a variety of heat exchangers. The instruction manual illustrates 35 standard symbols and gives step-by-step instructions for drawing them.

5. Double Drum Dryer

EASY CLEANING, quick adaptability to different production uses, and ability to operate by semi-skilled labor are important characteristics of a new atmospheric double-drum dryer that has been introduced by the F. J. Stokes Machine Co., 5920 Tabor Road, Philadelphia, Pa. Wherever possible the new dryer employs welded steel rather than cast iron. Working parts are all easily accessible, yet are sealed within the main housing. This construction, plus the fact that conveyor troughs can be inverted, is said to make it possible to wash the machine down without getting water where it does not belong. Conveniently located controls are provided for the angle and pressure of the doctor knives while a quick acting pressure release device is employed to avoid damage to the drums from hard particles or foreign matter. Drum drive speeds are variable by either mechanical or electronic controls while journal bearings are of the anti-friction type, equipped with labyrinth seals and force feed lubrication. A variety of types of both bottom and top feed systems are available to suit the characteristics of various materials, while semi- or total-inclosures can be provided if needed.

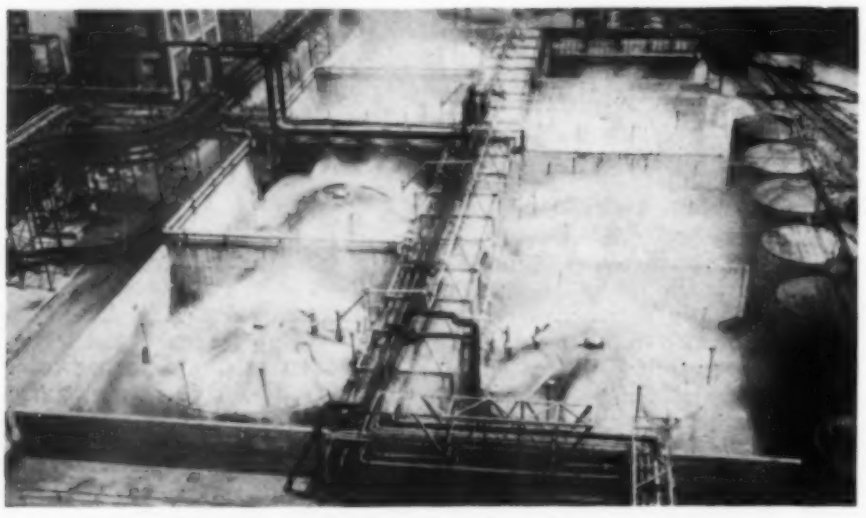
Cost Indexes for Typical Process Equipment

IN OUR issue of November 1947, pages 124-126, we presented for the first time the Marshall and Stevens indexes for comparative costs of equipment in eight typical process industries and four closely related industries, together with an average index for the 47 different industries, process and non-process, that are regularly covered in this evaluation firm's studies.

R. W. Stevens, partner of this Chicago and Los Angeles firm, described the methods of obtaining the index numbers in that issue, and listed the indexes back to 1913. At intervals we plan to reprint the complete tabulation from 1913 to current date, while quarterly figures will be published henceforth in our February, May, August and November issues. The quarterly indexes will include: "Year Ago," "Last Quarter," and "This Quarter."

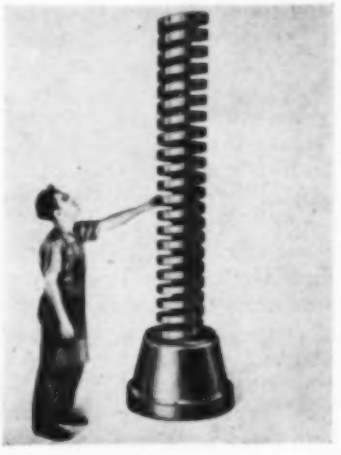
Marshall and Stevens Indexes of Comparative Equipment Costs (1926=100)

Industry	Sept. 1947	June 1948	Sept. 1948
Average of all	152.8	160.5	166.5
Process Industries			
Cement mfg	147.2	153.9	160.5
Chemical	154.2	161.9	168.5
Clay products	142.5	148.9	155.5
Glass mfg	145.1	152.0	158.6
Paint mfg	148.7	155.2	161.8
Paper mfg	149.9	155.5	162.1
Petroleum ind	149.6	158.3	164.9
Rubber ind	154.1	160.7	167.3
Process ind. avg	151.8	159.2	165.9
Related Industries			
Elec. power equip	152.9	163.5	170.1
Mining, milling	155.9	162.6	169.2
Refrigerating	166.3	173.3	181.5
Steam power	144.5	150.6	157.2



6. Waterfog Controls Tank Farm Fire Hazards

Tennessee Eastman Corp., at Kingsport, Tenn., is using a new waterfog fire control system as protection against a number of potential fire hazards. Shown here is the system undergoing test on a group of eight storage tanks. A similar system is available to smother fire in the company's distillation building. The system, which operates automatically in 12 to 18 seconds in the event of fire, was installed by the Rockwood Sprinkler Co., Worcester, Mass.



7. Vibratory Elevator

EMPLOYMENT of a spiral trough to which vibratory motion is imparted has enabled the Syntron Co., Homer City, Pa., to introduce two new elevating devices for handling bulk materials such as powders and small articles. The type illustrated uses a spiral elevating ramp up which material can be made to flow at a controlled rate by high-speed, electrically imparted vibration. This feeder is available in limited heights and diameters, the maximum tonnage required determining the diameter of the spiral ramp. On a somewhat smaller scale, another device has been introduced consisting of a bowl to contain the bulk mate-

..a hole in your pocket?

Are you overlooking the holes in your "plant's pocket" . . . the little day-to-day losses that add up to big money?

A good way to stop those profit-eating losses is to be sure of equipment that eliminates the chance for human error . . . equipment such as Fairbanks-Morse Recording Scales.

Your scale may test accurately, but the person who reads it is just human . . . and it is human to err. That is why industry is installing more and more Printomatic Recorders . . . the scale that eliminates the human element. Just press a button and the weight is recorded on a ticket or tape. It's the fastest, most accurate and dependable way—"to weigh."

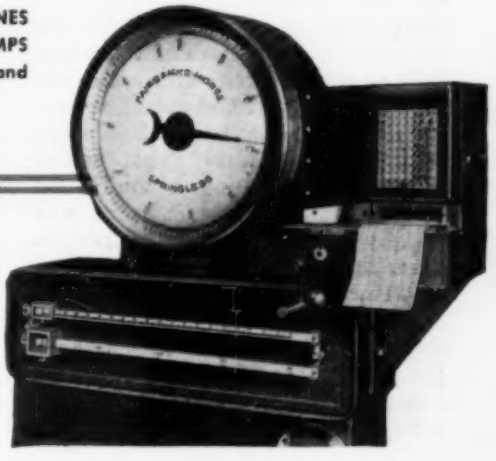
Why not have your local Fairbanks-Morse weighing expert show you how the Printomatic Recorder can help your operations. He will be glad to do so without any obligation. Fairbanks, Morse & Co., Chicago 5, Ill.

When it comes to scales

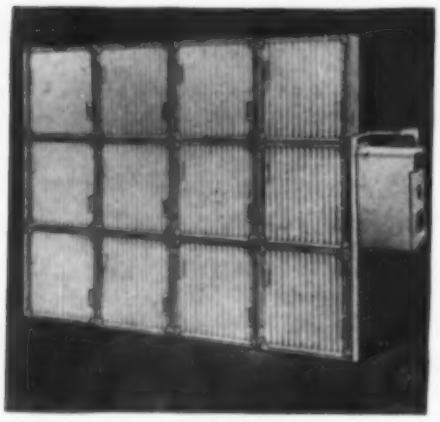
FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES
STOKERS • SCALES • MOTORS • PUMPS
GENERATORS • RAILROAD MOTOR CARS and
STANDPIPES • FARM EQUIPMENT
MAGNETOS



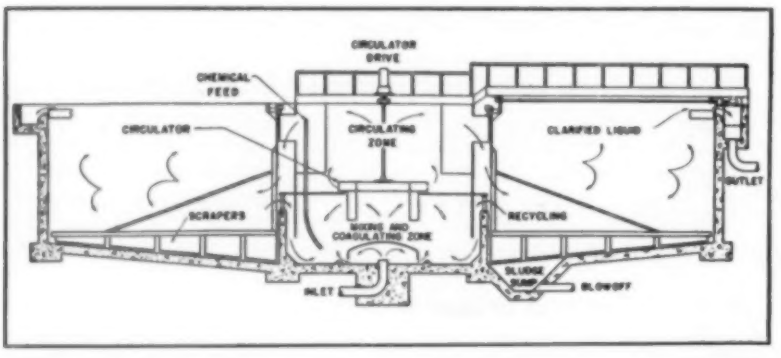
rial or small parts, with a grooved track ramp up the inside wall of the bowl which elevates and feeds the material, also at controlled rate.



8. Electronic Air Filter

DESIGNATED as the Electro-PL, an electronic air filter employing an electrostatically charged multi-layer cellulose filter medium as the collecting agent has been introduced by the American Air Filter Co., First and Central Ave., Louisville 8, Ky. The new type is intended for applications requiring a cleaning efficiency intermediate between that of mechanical filters, and of electrostatic precipitators. Basically, the new filter is an electronic precipitator without an ionizing unit. Electrostatically charged Airmat paper is the collector element. When an electrostatic charge is applied to the paper, the plies tend to separate and each individual fiber becomes a collecting electrode which attracts and holds dust and smoke particles.

Since the unit will continue to function as an efficient mechanical filter when de-energized its operation may be varied to suit dust conditions. For example, it may be used as an electronic air cleaner during the winter months when a smoky atmosphere is prevalent, and as a dry type air filter during the summer months. This simplification in design results in lower first and power costs as compared with electronic precipitators. Maintenance is simplified since the low cost filter paper employed can readily be replaced with new material when it accumulates its full dust load.



9. Waste Treater

TO PROVIDE for economical treatment of paper mill white waters and other industrial wastes, Infilco Inc., 325 West 25th Place, Chicago 16, Ill., has introduced the Cyclator, a combination of treater and thickener designed to give maximum clarification of waste waters with minimum capital expenditure and operating cost. Two existing installations have been operating successfully for several months, one treating a soluble oil emulsion, and the other paper mill white water. The first installation reduces the oil emulsion from an initial 2,300 ppm. to 10-20 ppm. The second installation reduces suspended solids in the white waters from 4½ lb. per 1,000 gal. to 0.25 lb. per 1,000 gal. and recovers fibers worth about $122 per day, which is somewhat higher than total operating costs including maintenance and depreciation.

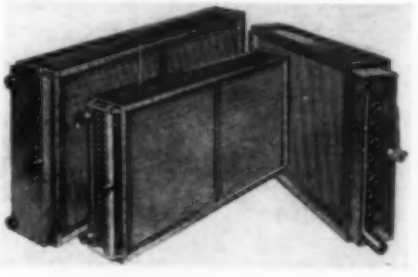
The accompanying drawing shows how the new unit works. Waste liquors are introduced to the mixing and coagulating zone where they are mixed with treating chemicals and recycled previously precipitated solids. The wastes are thus coagulated in the presence of a thick slurry of previously formed precipitate. From the mixing zone material is lifted by a variable speed circulator into a circulating zone consisting of two concentric sections, with an upward flow in the inner section, and a downward flow in the outer. Flow then passes into the clarification zone where precipitates are settled out and clarified water is withdrawn at the surface. Settled solids are thickened and removed to a collection sump by means of a rotating scraper mechanism.

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

10. Flowmeter Tube

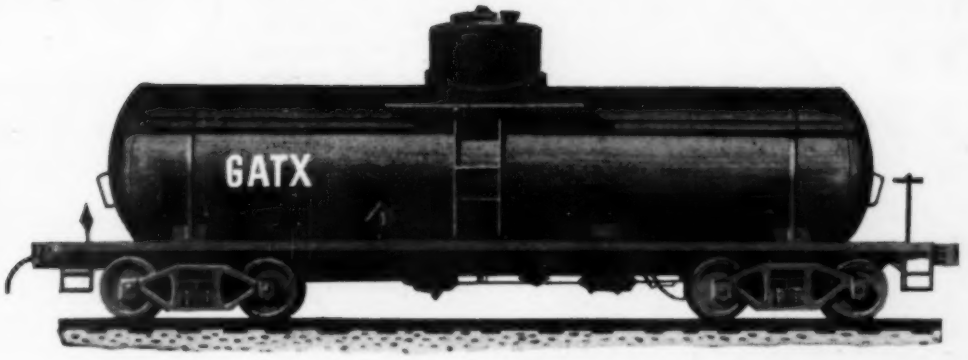
HIGHER ACCURACY, with smaller loss of pressure head than is obtained with other types of differential producers used for metering flow, is claimed for the Gentile flow tube which is now being manufactured by the Bethlehem Foundry & Machine Co., Bethlehem, Pa. The device is suitable for metering gases, vapors or liquids and can be employed with any kind of manometer. The range of flow that can be metered is said to be greater than with other differential producers, while the differential itself is greater and is always a power of the velocity, which is said to result in constant accuracy over the entire range of commercial flow measurement.

This flow tube consists essentially of a short length of pipe equipped with two groups of pressure nozzles around the inner periphery, one group pointing upstream, the other downstream. The nozzle groups are interconnected by common pressure rings from which connections are made to the high and low pressure sides of a standard flowmeter. Since the device is symmetrical, it can measure flow in either direction. In tests at Worcester Polytechnic Institute it was found that the tubes have a constant discharge coefficient over a range of 8 to 1, compared to a 3 to 1 range for most commercial devices. It is unnecessary to take precautions where downstream pressure may fall below the critical value, and the numerous corrections in metering gases and vapors with other differential producers are unnecessary.



11. Cooling Coil

AS PART of a wide selection of extended-surface heat-transfer equipment, Modine Mfg. Co., Racine, Wis.,



AN IMPORTANT MESSAGE TO ALL TANK CAR SHIPPERS PLANNING EXPANSION

The demand for tank cars is so great today that many shippers are not able to meet their present transportation requirements. General American is doing everything possible to relieve this situation by producing as many cars as our supply of materials will permit.

However, we urge those of our customers who are acquiring or planning new plants to anticipate shipping requirements as many months in advance as possible. To avoid any unnecessary delay in future shipping of bulk liquids, we suggest that your traffic department check with General American on possible car availabilities well ahead of your actual needs. Consult your nearest General American district office.

GATX GENERAL AMERICAN TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street • Chicago

DISTRICT OFFICES • Buffalo • Cleveland • Dallas • Houston • Los Angeles • New Orleans • New York • Pittsburgh • St. Louis
San Francisco • Seattle • Tulsa • Washington

LUBRIPLATE Lubricants are a paradox. They not only possess enormous film strength to withstand the heaviest loads but they function with minimum drag, hence conserve power. The "stay-put" quality of these unique lubricants means less frequent application and less lubricant consumption. Yes, they are most economical too. Write for particulars.

LUBRIPLATE

Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE

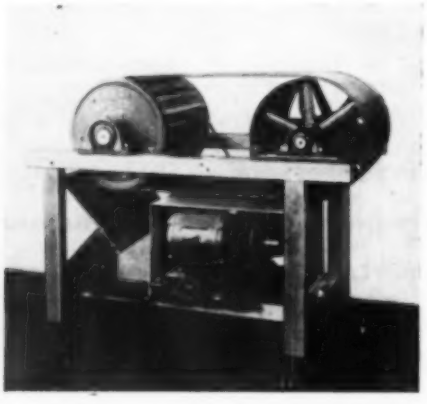
Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE

Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

LUBRIPLATE
FISKE BROTHERS REFINING CO.
NEWARK 5, N. J. TOLEDO 5, OHIO
DEALERS FROM COAST TO COAST
CONSULT YOUR CLASSIFIED TELEPHONE BOOK

has introduced a new line of cooling coils available in numerous types, styles, models and sizes. Coils for use with chilled water are provided in standard and cleanable styles in a total of 24 models, and in 5 casing widths and 17 casing lengths. Direct expansion type coils are furnished in 4 models in the same casing dimensions. Thus, a total of 2,380 individual cooling coils is available to choose from. In these coils the tubes, fins, headers, inlet and outlet connections of both the water and direct expansion types are made entirely of copper and copper-base alloys for maximum heat transfer. Avoiding the use of dissimilar metals eliminates the possibility of electrolysis and thus gives greater resistance to corrosion. The fins, which are die-formed to increase heat transfer and minimize resistance, are permanently bonded to the tubes with metal, and all mechanical joints are avoided by the use of brazing. The accompanying view shows a standard water coil on the left, a cleanable coil at the center, and a direct expansion coil at the right.



12. Magnetic Pulley

UNDER the name of "Puri-Pulley," the Eriez Manufacturing Co., 593 Commerce Bldg., Erie, Pa., has introduced a new type of permanent-magnet pulley separator. In the new pulley, the strength is concentrated close to the face plate to permit the automatic separation of ferrous from non-ferrous material ranging in size from 10 to 200 mesh. Design characteristics, as well as new Alnico magnetic material used, account for the additional strength. Effective cleaning surface has been increased substantially by narrowing the air-gap and increasing the number of pole plates. The unit is said to be suitable for removing fines from such materials as talc, chemicals, salts, glass sand, ball clay, granulated slag, rubber, and other substances requiring a high degree of purification. The unit is built as a head pulley in a belt conveying system, and is available in 18- and 24-in. diameters, in belt widths ranging from 12 to 60 in.

13. Paste Mixer

WHAT is described by the manufacturer as a "double egg-beater action" is incorporated in a new paste mixer offered by Hy-R-Speed, Inc., 1127 Riverside Drive, Los Angeles 31, Calif. Intended primarily for use by paint manufacturers, it is claimed that a reduction of 25 to 50 percent of mixing time has been reported under actual factory operating conditions. Two sets of counter rotating blades provide fast, smooth, thorough mixing and shear action. Low power consumption is claimed. The unit operates smoothly and quietly and does not require a permanent mounting. In fact, it can be portable, if desired. The unit combines a 100-gal. capacity mixing tank, a motor and an inclosed gear box.

14. Ultrasonic Gage

EMPLOYING ultrasonic vibration, the Metroscope is a new product of Photocon Research Products, 1062 North Allen Ave., Pasadena 7, Calif. The device can measure wall thickness of a long tube since its ability to obtain information is not limited by accessibility. It can also be used for detecting flaws which may or may not appear in X-ray film. The device em-

For Any Atmospheric Hazard There's a CENTURY MOTOR— Properly Protected—To Assure Continuous Performance

To protect motors against the hazards of abnormal atmospheres, Century provides Totally Enclosed Fan Cooled and Explosion Proof frames, also Splash Proof.

These are in addition to open type frames on which the upper half of the frame is protected against falling or dripping particles.

Whatever your requirements there's a Century motor designed to accurately meet the needs of your equipment.

The illustrations here are typical of the variety of applications which are successfully powered by Century motors.

1 — Century 7½ horsepower *totally enclosed fan cooled* motor drives an elevator leg in a dusty, dirty atmosphere.

2 — Century 5 horsepower *explosion proof* motor provides protection against explosions at a gasoline storage plant.

3 — Three horsepower Century *splash proof* motors provide protection from splashing water as well as from all kinds of weather conditions on a railroad car-washing unit.

4 — Century 100 horsepower *general purpose* motors are used to drive air compressors in clean surroundings.

Century builds a complete line of fractional and integral horsepower electric motors in sizes from 1/6 to 400 horsepower to meet the requirements of industrial production, commercial and appliance needs.

Specify Century for all your electric power requirements.

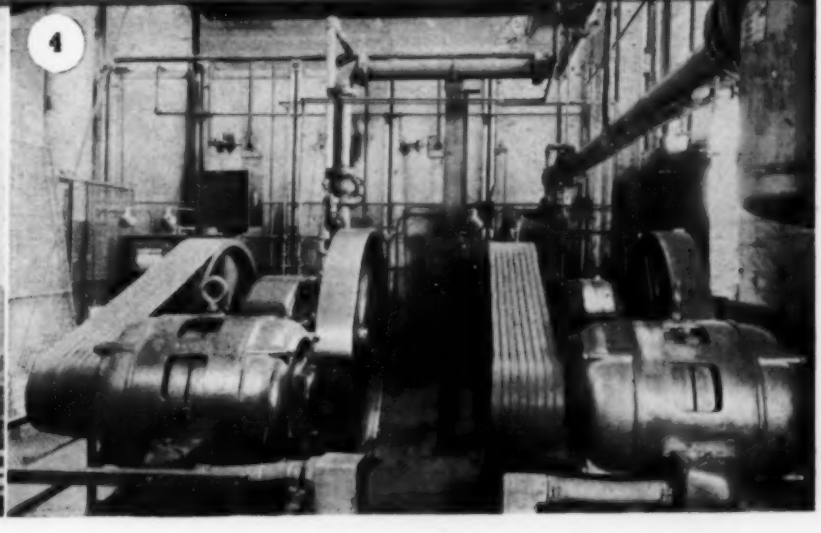
CENTURY ELECTRIC COMPANY

1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS

CE592



HIGHLY PROFITABLE MAGNET OPERATION*

"Several months ago we installed one of your RECTANGULAR SUSPENDED MAGNETS ahead of one of our Launder Baum Jig combination washers and have found this magnet installation not only satisfactory in removing tramp iron from the raw coal, but it has been highly profitable in the salvaging of material which can be readily returned to the mines and reused.

"We are so enthusiastic over the performance of this magnet that we have purchased six more for delivery in the near future.

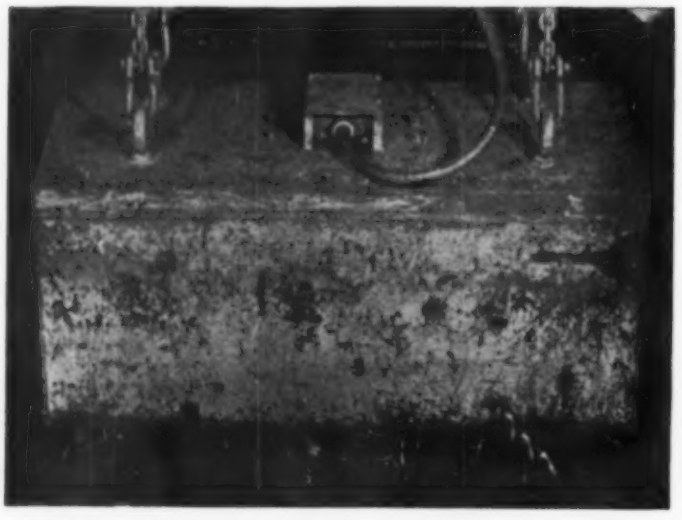
"You may be interested also to know that these magnets will replace other types magnets manufactured by other concerns."

*Name on application.

OUR Customer WROTE This AD

Letters like this confirm our belief that a well designed, magnet, carefully built, results in satisfied and enthusiastic users and—is its own best salesman. See picture below.

Stearns Magnets are designed in all practicable sizes and shapes to suit your application whether it be for lifting or suspended separation purposes. If you want a dependable, powerful magnet, consult Stearns Magnetic, Milwaukee.



Stearns

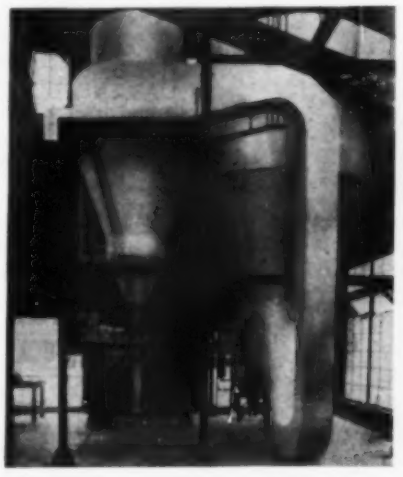
SEPARATORS • ROLLS • DRUMS
CLUTCHES • BRAKES • SPECIAL MAGNETS

MAGNETIC MFG. CO.

629 S. 28th St., Milwaukee 4, Wis.

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

ploys an electronic oscillator to generate electrical voltage, the frequency of which is varied throughout the tuning range. The point or points in this tuning range at which the part resonates are indicated, and since resonant-frequency and thickness are related for any given material, it is possible to calibrate the instrument to read thickness directly.



15. Compact Spray Dryer

DESIGNED for fully automatic operation, a new spray dryer for the production of 5 to 10 tons of finished product per day, with an exceedingly high production rate for its size, is being offered by Bowen Engineering, Inc., 420 North Ave., Garwood, N. J. The dryer is furnished as a complete operable unit, requiring a minimum amount of field erection. Important features include complete instrumentation of safety controls, plus arrangements designed to facilitate adjustment and flexibility of operation. The dryer is produced in both mild steel and stainless steel construction, with direct or indirect heaters, single or multi-stage dry product collection and wet collection, and various types of atomizers for the production of the particular particle characteristics desired. Complete floor space required is only 12 x 20 ft. If desired, the unit may be installed out of doors.

Correction: Through inadvertence the name of the manufacturer of item 22, described on page 168 of our September 1948 issue, was omitted. The missing name is that of Alhydro,

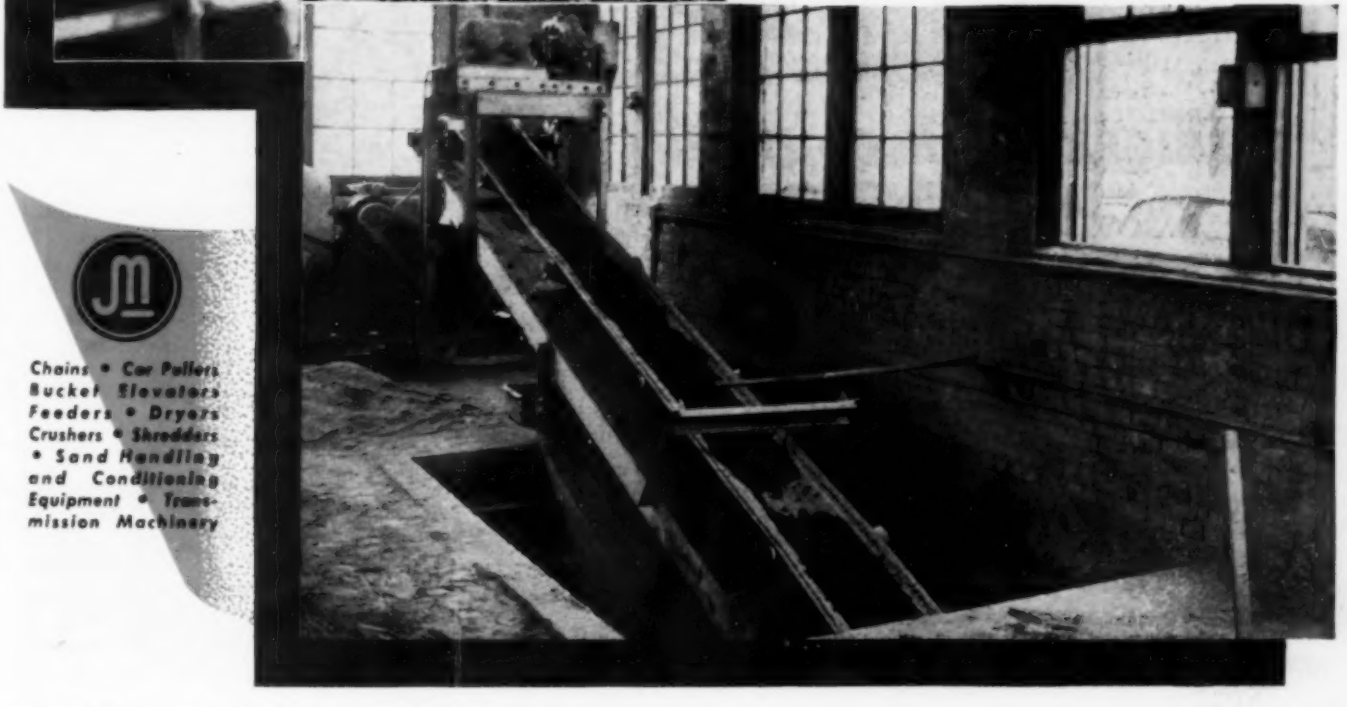
Material Takes A Non-Stop Flight On

FAST-MOVING JEFFREY BELT CONVEYORS

Both large and small jobs

Keeping production moving without a break is important . . . fast-moving production lines require dependable and sturdy equipment . . . the kind that Jeffrey builds. Belt conveyors are sure fire in any well-organized handling systems. But Jeffrey also makes other types of conveyors . . . chain, apron, pivoted bucket, V-bucket, spiral, scraper and electric vibrating types . . . to help you coordinate your material handling requirements into a smooth-running system. We will be glad to study your needs . . . can supply technicians and engineers who know.

THE JEFFREY
MANUFACTURING CO.
Established 1877
909-99 North Fourth St.
Columbus 16, Ohio
Sales Offices in Principal Cities



Chains • Car Pullers Bucket Elevators Feeders • Dryers Crushers • Shredders • Sand Handling and Conditioning Equipment • Transmission Machinery

THE HEART OF A GOOD FILTER IS ITS FILTER LEAVES

You can depend on KLEIN

• POSITIVE FILTRATION • NO CLOGGING
• FULL DRAINAGE

Klein Ideal Diatomaceous Earth Filters and the exclusive Klein Filter Leaves, in combination, assure positive filtration at all times. Operation, cleaning and maintenance costs are at a minimum with Klein Filters. In addition, many radical innovations are incorporated in Klein Ideal Filters. You'll want to know about all of these if you have an industrial, chemical or food filtration problem in your plant.

Write for latest Klein Bulletin

Klein Filter Leaf—if damaged, metal cloth easily replaced. No rivets. Note horizontal headers—central duct—Klein Cleanout Cap.

KLEIN ESTABLISHED 1909
FILTER & MANUFACTURING COMPANY
1225-29 School Street • Chicago 13, Illinois

COOLING CORROSIVE LIQUIDS

Shell and Tube Cooler with KARBATE Tubes, Tube Sheets and Bonnets. Used to cool highly corrosive liquid flowing through Tubes by means of brine in shell.

REFRIGERATION EQUIPMENT BY DOWNINGTOWN

We solicit your inquiry for *heavy duty shell and tube equipment*. In addition to "run-of-mill" items, we design and build:

Coolers for oils, fruit juices, solvents and special liquids.
Liquid precoolers, gas intercoolers for multistage jobs.
Condensers for Freon-22, propane and other refrigerants.
Seawater condensers (Cupro-nickel tubes, tube sheets).

Design and construction meet standards of A.S.M.E., Coast Guard, or other agency specified by customer.

All equipment of our design is sold on a guaranteed performance basis. We also fabricate to customer's drawings.

Modern facilities available for checking of welding operations by X-Ray.

Write on your letterhead for *Downingtown* literature on shell and tube equipment for refrigeration.

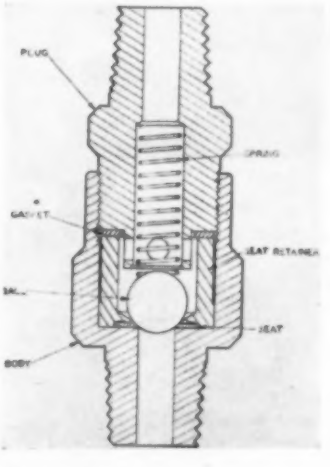
DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

NEW YORK OFFICE: 30 CHURCH STREET

Inc., 516 North Charles St., Baltimore, Md., manufacturer of a new electrolytic aluminum hydroxide floc producer for water treatment plants.

16. Vacuum Indicator

To SUPPLEMENT its line of vacuum recording equipment with a portable indicator, the George E. Fredericks Co., Bethayres, Pa., has combined an indicating meter with its Model 500 Televac thermal gage for measuring vacuum within the range of 0 to 1,000 microns. The instrument is a continuously indicating type and it is claimed that, by the use of specially coated filaments, the calibration is unaffected by contaminating vapors in the vacuum system. The special indicating meter is made by Weston and the complete unit is known as Televac Model 1.

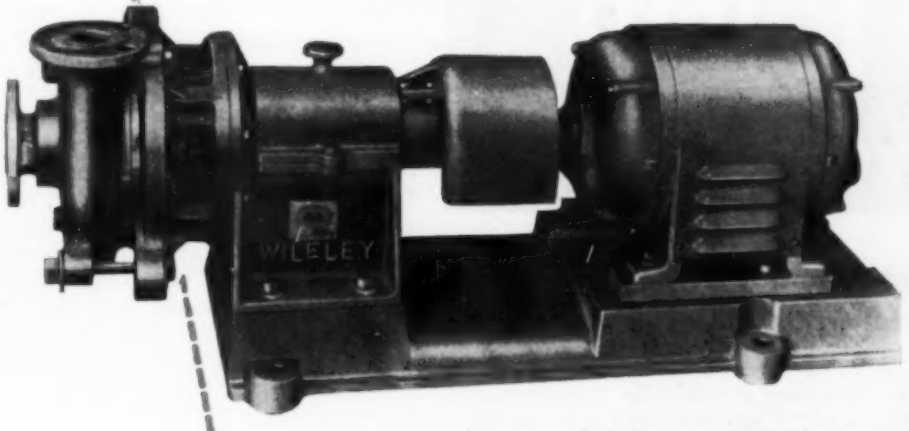


17. Check Valve

THE USE of a soft, non-extruding plastic as a valve seat in check valves of its manufacture has been announced by Hoke, Inc., Englewood, N. J. It is claimed that these valves are now able to withstand high back pressures without danger of seat damage. The new plastic seats are said

FOR

Acids

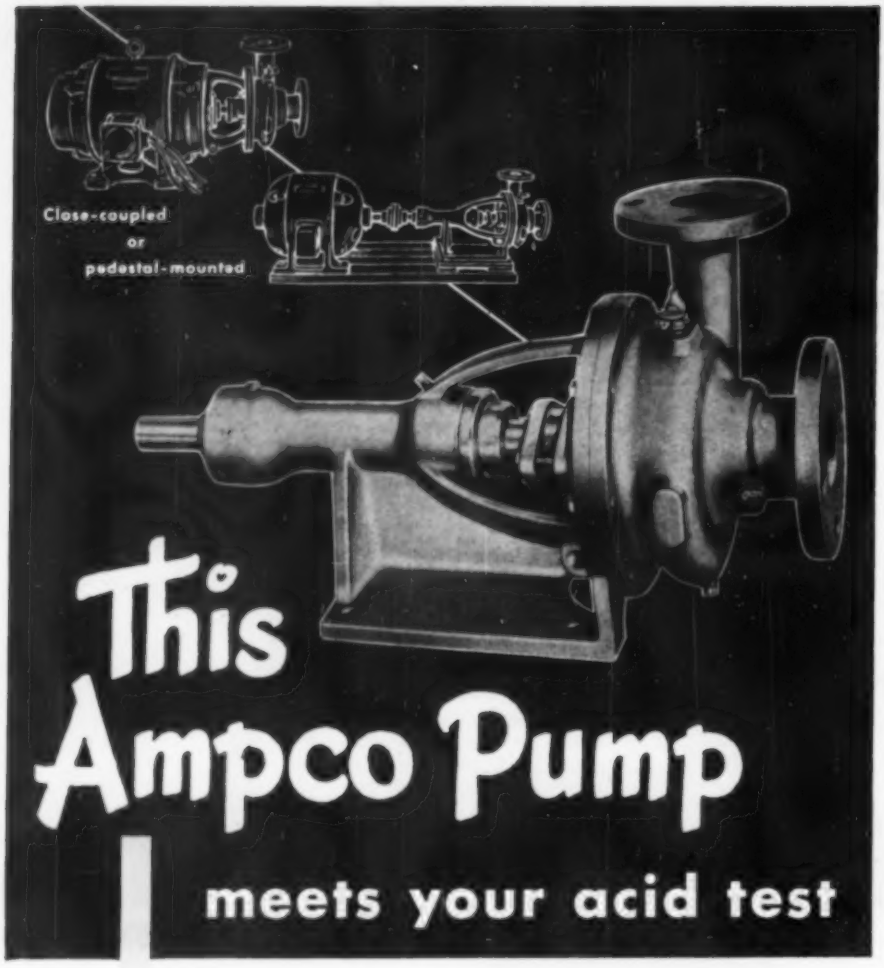


Dependable, trouble-free performance that reduces costs and keeps production up... is a well-known proven characteristic of the WILFLEY Acid Pump. Acids, corrosives, hot liquids, mild abrasives and other solutions on a 24-hour schedule, operating without attention. 10- to 2,000-G.P.M. capacities; 15- to 150-ft. heads and higher. Intermittent or continuous operation. Individual engineering on every application. Write or wire for complete details.

WILFLEY
centrifugal **PUMPS**

A. R. WILFLEY & SONS, INC., DENVER, COLORADO, U. S. A.

New York Office: 1775 Broadway, New York City



— a corrosion-resistant pump sold as a standard model without a price premium

You don't have to pay extra for special production to get a corrosion-resistant pump. Ampco's aluminum bronze centrifugal pump is a standard model — at standard-model prices.

With this new pump, you can cut the cost of original equipment, reduce replacement frequency, and be sure of efficient handling of your corrosive and erosive thin liquids. Its corrosion-resistance prevents contamination. All passages are designed for smooth, quiet flow. Grades of aluminum bronze are varied to give maximum efficiency at each point. Operation in a 500° F ambient does not change its physical properties. It is the only bronze pump that can be welded or overlaid—Ampco-Trode 10 electrode matches the base metal perfectly.

Actual performance records prove the value of this pump in breweries, and in petroleum, chemical, and food processing industries. See your nearby Ampco engineer for full details. All sizes are available either pedestal-mounted, or close-coupled to a face-type motor. Write for bulletins.

Ampco Metal, Inc.

Dept. CM-11 • Milwaukee 4, Wisconsin

FOR MORE INFORMATION
See Reader Service
Coupon on pages 181-182

not to tend to fly to pieces under back pressures in excess of 1,000 lb. Nevertheless, the valves are claimed to seal off and open at very low pressure differentials.

Equipment Briefs

18. Experimental work by H. K. Porter Co., 1932 Oliver Building, Pittsburgh 22, Pa., is said to have shown that irregularly spherical balls are preferable to perfect spheres for ball mill grinding. The company therefore has introduced a new Tuffalloy steel ball which is shaped like a sphere pushed out of shape with flattened areas here and there on its surface. The flattened surfaces present broad areas of impact and are said to assure positive grinding action, with increased thoroughness and speed of grinding.

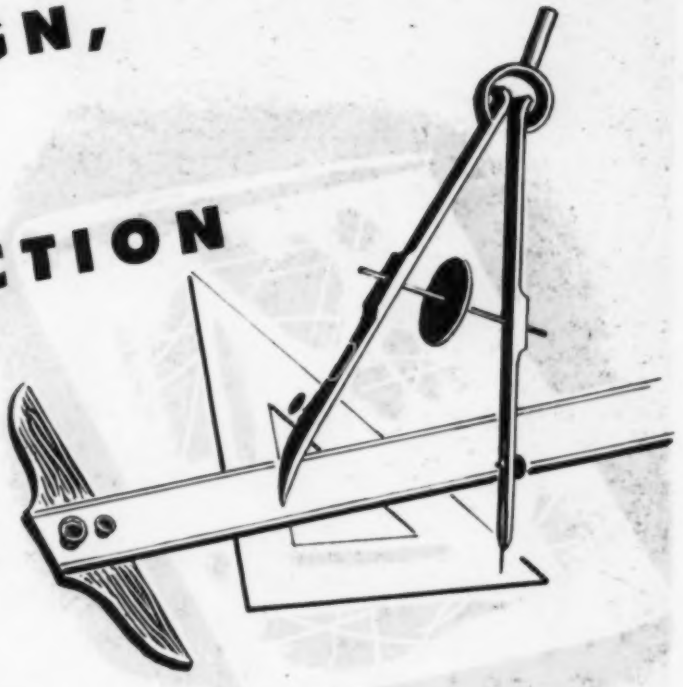
19. Excellent resistance to such corrosive materials as hydrochloric, nitric, chromic and hydrofluoric acids is claimed for a new liquid plastic coating material known as Enthonite 101. Offered by Enthone, Inc., 442 Elm St., New Haven, Conn., for applications such as the coating of plating racks, this material is supplied as a viscous liquid containing 100 percent solids (i.e., no solvent), which is applied by dipping to produce coatings varying in thickness from $\frac{1}{8}$ to $\frac{1}{4}$ in. The material is applied over a primer coat and is baked at a temperature of 350 deg. F. or higher for a short period of time. All drippings can be reclaimed and reused.

20. The new Paul straight-through valve is now available lined with hard rubber, according to a recent announcement of the American Hard Rubber Co., 11 Mercer St., New York, N. Y. This valve employs a cast iron body with flanges and all working parts covered with hard rubber. The ball which automatically seats in the venturi-type midsection of the valve, is of hard rubber. The valve is equally effective in stopping flow in either direction. Rubber lined valves are produced in sizes of 2 to 4 in., for pressures to 150 psi.

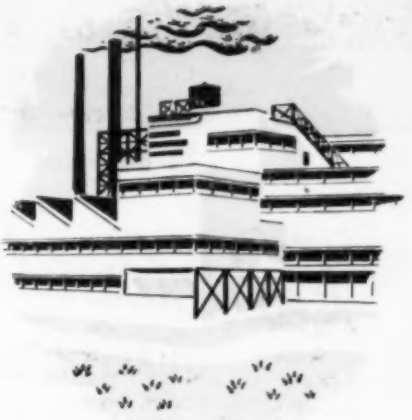
21. Following work in cooperation with steel mills on the disposal of waste pickle liquor, Filtration Engi-

BUILDERS FOR INDUSTRY

PROCESS DESIGN, ENGINEERING and CONSTRUCTION



Serving the chemical industries, Bechtel Corporation's engineers are in the vanguard of progress in industrial chemistry—exploring processes, relating them to economics, and designing plants for widely diverse purposes. Completion by experienced Bechtel construction men assures a turn-key operation delivering planned capacity —performing at planned efficiency.



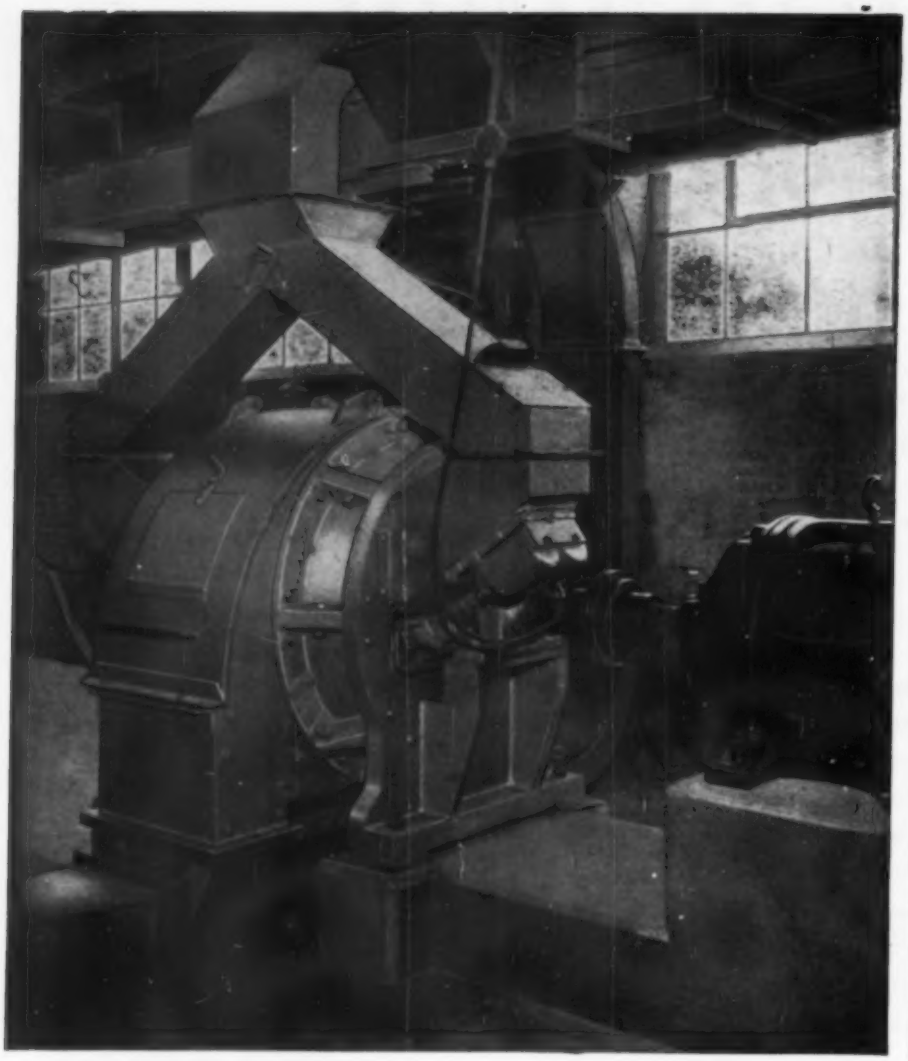
Services are available in every part of the world through Bechtel Corporation and Bechtel affiliates.

BECHTEL CORPORATION

SAN FRANCISCO • LOS ANGELES
NEW YORK

BECHTEL

ECONOMIC STUDIES • PROCESS DESIGN • ENGINEERING • PURCHASING • CONSTRUCTION



Reduction Problems?

QUALITY CONTROL IS THE ANSWER

If the mechanical reduction of materials is your problem, let us show you what the Prater Dual-Screen Pulverizer will mean in your processing operation. Let us show you how Prater Triple Reduction Grinding (with dual or side feed) carries the material through three distinct stages to give you absolute control over the quality of the granulation.

Quality control is the direct result of precrushing, peripheral distribution, selection and arrangement of final sizing blades plus dual screening through screens which cover over 70 percent of the area of the drum . . . all details we would like to tell you more about.

Write: The Prater Pulverizer Company, 1517 South 55th Court, Chicago 50, Illinois.

PRATER PULVERIZERS

neers, Inc., 858 Summer Ave., Newark 4, N. J., has announced the development of a new small continuous vacuum filter particularly for this waste disposal problem. It is said to be useful in conjunction with any waste-acid neutralizing process which results in a suspension of iron oxides and other solids in a neutralized solution. Using a string discharge, it produces an easily handled solid cake and a clear filtrate which can be released into watercourses without danger of acid pollution.

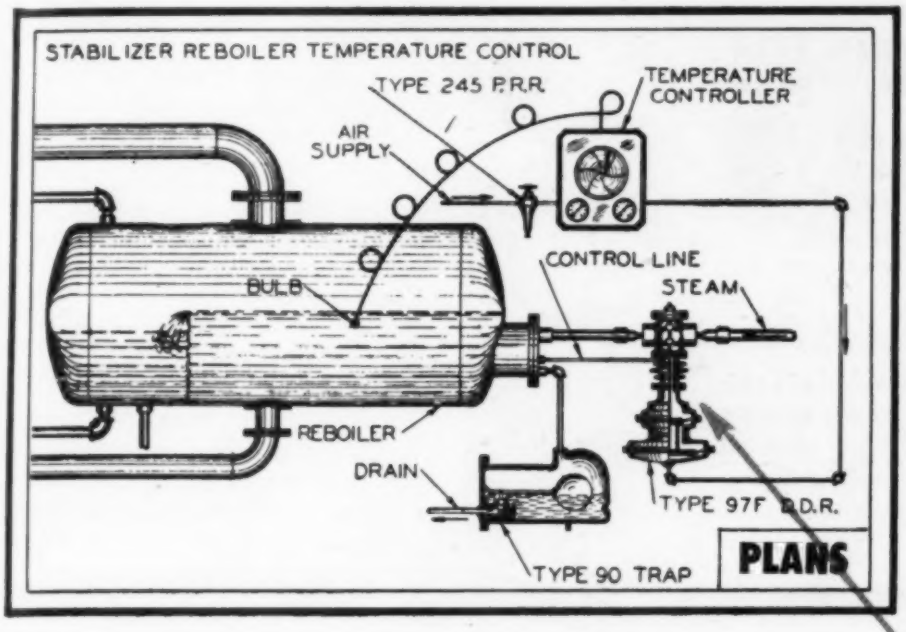
22. A NEW MACHINE which automatically imprints codes, batch numbers, expiration dates and other variable markings on any shape of small rectangular and die-cut labels has been introduced by Adolph Gottscho, Inc., 1 Hudson St., New York 13, N. Y. Known as the Corliss-Coder, the machine is completely automatic, holding about a full hour's capacity of labels and printing them without any attention from an operator. The combination of its various features is said to have resulted, in the case of one pharmaceutical manufacturer, in annual savings of almost $100,000 on label-coding cost, as compared with previous equipment available.

23. PARTICULAR application is indicated in industries having explosive hazards for a self-powered telephone produced by the Wheeler Insulated Wire Co., Waterbury, Conn. No external source of electrical power is required and yet the instrument is said to function satisfactorily at distances up to 20 miles. Both talking and ringing circuits are claimed to be entirely free of all electric sparks and to generate no heat.

24. CLAIMED to have greatly increased power, a new Rotojet Junior cleaner for small tubes has been introduced by the Roto Division of the Elliott Co., Newark 1, N. J. Motors, which are available for operation on either air or water, have only two moving parts. A variety of cutter heads and brushes is available for cleaning tubes as small as 0.495 in. I.D.

25. FACTORY-MADE preformed pipe-fitting covers of Foamglas, for both hot and cold fittings, are now available from Pittsburgh Corning Corp., 632 Duquesne Way, Pittsburgh, Pa. These covers are for use with the recently introduced Foamglas pipe insulation. They are available in all sizes for L's, T's, unions, valves, elbows and flange covers, and are said to cost less on an annual basis than other insulations. They are suitable for temperatures from −200 to +800 deg. F.

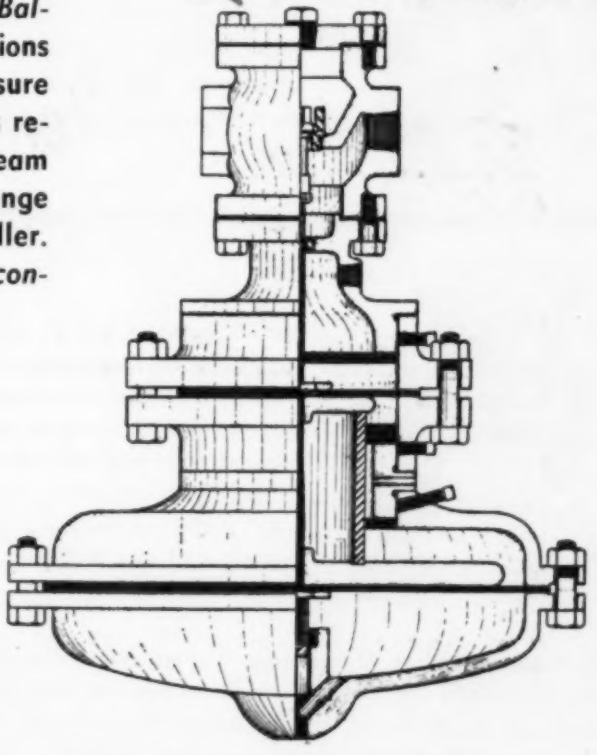
Do Your Plans Specify a Control Valve That Is PRESSURE COMPENSATED?



When your designer specifies Climax you can expect maximum efficiency and service life, a minimum of shut-down and maintenance worries. The entire staff of experienced Climax engineers is ready to aid you in *any* control problem. Get off a letter, today.

• *Climax Type 97 Duplex Diaphragm Pressure-Balanced Control Valves* are furnished with fin sections as control valves on steam to reboilers. The pressure balanced, stuffing box-less construction permits reset of inner valve position for changes in steam header pressure or reboiler loads prior to a change of output pressure from the temperature controller. This pressure compensation makes for *easier control, eliminates Valve Positioners.*

*Patent No. 2,265,599



Call for

climax

DUPLEX DIAPHRAGM—CONTROLLED REGULATORS

Climax Engineering Co. Controls Division

CLIMAX ENGINEERING CO.
CONTROLS DIVISION
15 N. CINCINNATI TULSA, OKLA.

If you're interested in valves that will give you any or all of these operating advantages then you'll be interested in

NON-CONTAMINATING

MINIMUM MAINTENANCE

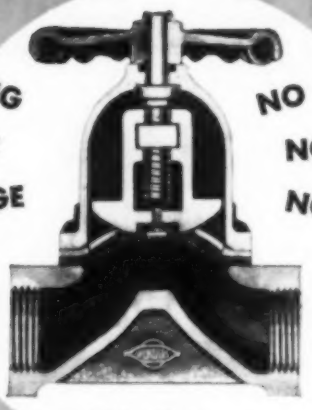
NO VALVE STEM LEAKAGE

NO CORROSION

NO CLOGGING

NO SEEPAGE

GRINNELL - SAUNDERS DIAPHRAGM VALVES



Valve Open

Valve Closed

FOR CHEMICALS

Stainless Steel valves with special diaphragms are handling satisfactorily such corrosive chemicals as phosphoric, acetic and chromic acids.

FOR BEVERAGES

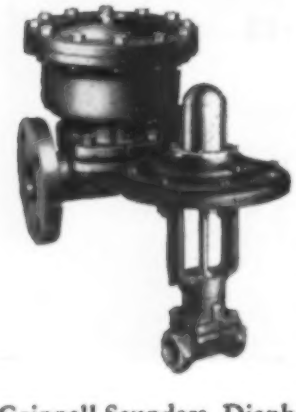
Bronze valves with socket ends (left) and with hose threaded end (right), both with special white rubber diaphragms, are stopping leaks and cutting maintenance to the bone in breweries handling millions of barrels of beer.

FOR PULP and PAPER

Rubber lined valves are setting new performance records handling pulp, alum and sulphuric acids in paper mills.

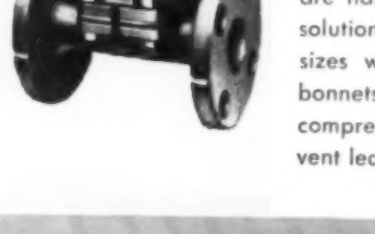
FOR TEXTILE PLANTS

Aluminum body valves with rising stems have won enthusiastic approval in bleacheries handling hydrogen peroxide and other chemicals.



FOR FOODS

Piston-operated valves (left) and air motor operated valves (right), both glass lined and with proper diaphragms, are providing remote control in plants handling sodium chloride, sodium hydroxide, sulphuric acid and fruit juices.



FOR MINES

Standard rubber-lined valves are handling highly abrasive solutions and slurries. Small sizes with quick-operating bonnets are widely used on compressed air lines to prevent leakage.

Grinnell-Saunders Diaphragm Valves may eliminate valve troubles and cut valve maintenance on your pipe lines. Available in any combination of valve bodies and linings, diaphragms and operating mechanisms. State your requirements or ask for Catalog 2-S on "Grinnell-Saunders Diaphragm Valves". Grinnell Company, Inc., Providence 1, R. I. Branch warehouses in principal cities.

GRINNELL

WHENEVER PIPING IS INVOLVED

Reader Service Page for . . .

NEW *Chemical Engineering* TOOLS

PRODUCTS AND MATERIALS • PROCESS EQUIPMENT • MANUFACTURERS' LITERATURE

Use these handy Reader Service cards for more information on this month's new products and equipment or for copies of latest trade literature.

PROCESS EQUIPMENT NEWS

See pages 165-178

Metal Radiant Heater.....165
Adjustable Sheave 165
Connector Panel 165
Flowsheet Templates 166
Double Drum Dryer.....166
Waterfog Fire Control System.....166
Equipment Cost Indexes.....166
Vibratory Elevator 166
Electronic Air Filter.....168
Waste Treater 168
Flowmeter Tube 168
Cooling Coil 168
Magnetic Pulley 170
Paste Mixer 170
Ultrasonic Gage 170
Compact Spray Dryer.....172
Vacuum Indicator 174
Check Valve 174
Irregularly Spherical Balls.....176
Liquid Plastic Coating.....176
Straight-Through Valve 176
Small Continuous Vacuum Filter.....176
Automatic Label Coder.....178
Self-Powered Telephone 178
Small Tube Cleaner.....178
Preformed Pipe-Fitting Covers.....178

NEW PRODUCTS & MATERIALS

See pages 185-198

Rust Inhibitor 185
Penicillin Drug 185
One-Coat House Paint.....185
Polystyrene Plastic 186
Rubber Softener 188
Vinyl Copolymer 188
Plasticizer for Vinyls.....190
Quick-Setting Glue 190
Greenhouse Aerosols 192
A Trio of Glycols.....192
Flame- and Moth-Proofing Compound. 194
Coconut-Base Detergent 196
Potent Local Anesthetic.....196
Two Antioxidants 198
Dyestuff Intermediate 200

MANUFACTURERS' PUBLICATIONS

See also pages 356-362

101. Demineralized Water. American Cyanamid Co., New York—A revised edition of a 28-page booklet indicates the potentialities of ion exchange in producing demineralized water that is the equivalent of distilled water at costs lower

OVER

Place Stamp Here

Reader Service
CHEMICAL ENGINEERING
330 WEST 42nd STREET
NEW YORK, 18, N. Y.

Place Stamp Here

Reader Service
CHEMICAL ENGINEERING
330 WEST 42nd STREET
NEW YORK, 18, N. Y.

Place Stamp Here

Reader Service
CHEMICAL ENGINEERING
330 WEST 42nd STREET
NEW YORK, 18, N. Y.

than those obtainable with distillation. Approximate operating costs are shown, the differences in cost due to locality being pointed out. Specifications for the standard demineralising units put out by this company are also included.

102. Boiler Controls. Hennsey Co., Watertown, Wis.—Four 4- and 6-page bulletins show the equipment produced by this company for boiler feed regulation, metering of boiler feedwater, continuous blowdown, and flow indicators. The bulletins give sizes and specifications for standard units and also include current prices.

103. Fans. Buffalo Forge Co., Buffalo, N. Y.—This 48-page booklet gives complete data on the Type LL, limit-load conoidal fans put out by this company. For each size fan, complete data is given on outlet velocity, capacity, rpm., and horsepower. Dimensions and installation arrangements are also included.

104. Instruments. Brown Instrument Co., Philadelphia, Pa.—This 48-page bulletin No. 7201 shows applications of instrumentation in the treatment of sewage and industrial wastes. The instrumentation required for individual treating units is shown, and the catalog also shows the instruments produced by this company for these applications. Instrument specifications are included.

106. Self-Priming Pump. Jabsco Pump Co., Burbank, Calif.—This 54-page catalog shows the small, self-priming, rubber-impeller pump put out by this company. The various pump models and sizes are shown, and prices are given. Data on the corrosion resistance of the impeller compound are also given.

106. Detergents. Ultra Chemical Works, Paterson, N. J.—This 30-page catalog, entitled "Basic Products," gives technical data on the detergents and softeners produced by this company. Other products of the company are also included.

107. Research. National Research Corp., Cambridge, Mass.—This 16-page booklet illustrates the facilities which this company has available for doing contract research work. Examples of the past research work done by this company are included. The majority of the examples deal with applications of high vacuum techniques.

108. Valves. A. W. Cash Valve Mfg. Corp., Decatur, Ill.—32-page Catalog D-14 shows the capacities, specifications, prices of the various valves produced by this company. Included are pressure reducing valves, strainers, hot water heat controls, and relief valves. Engineering data for determining the capacities of various pressure reducing valves are included.

109. Non-Skid Coatings. Endur Paint Co., Cambridge, Mass. This 4-page leaflet indicates possible applications for the carborundum-containing floor coating put out by this company. The coating is specifically designed for application to concrete floors.

110. Insulation. 48 Insulations, Inc., Aurora, Ill.—This 24-page catalog gives technical data and prices on the installation materials put out by this company. Included are cement, block insulation, insulating felts, insulating blankets, and various insulating materials. Charts and illustrations are given on the conductivity and installation of the various types of installations.

111. High Pressure. Autoclave Engineers, Inc., Chicago, Ill.—This 12-page leaflet shows the equipment manufactured by this company for operating pressures up to 100,000 psi. Included are valves, fittings, autoclaves and reactors.

112. Absorber Efficiency. Clark Bros. Co., Olean, N. Y.—This 32-page booklet shows the method of determining absorber extraction efficiency for actual units, which was developed by E. G. Ragats of this

(Continued on page 356)

These are good for items in this issue only and must be returned by January 31, 1949.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

Your Title .....

CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

11-48 Write here item number in which you are interested ▶ [ ]

Your firm's name .....

Address .....

.....

Your Name .....

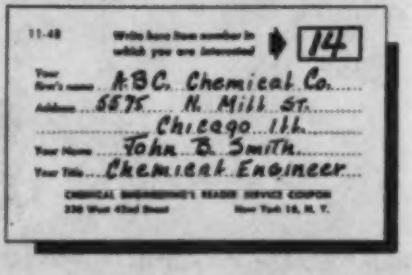
Your Title .....

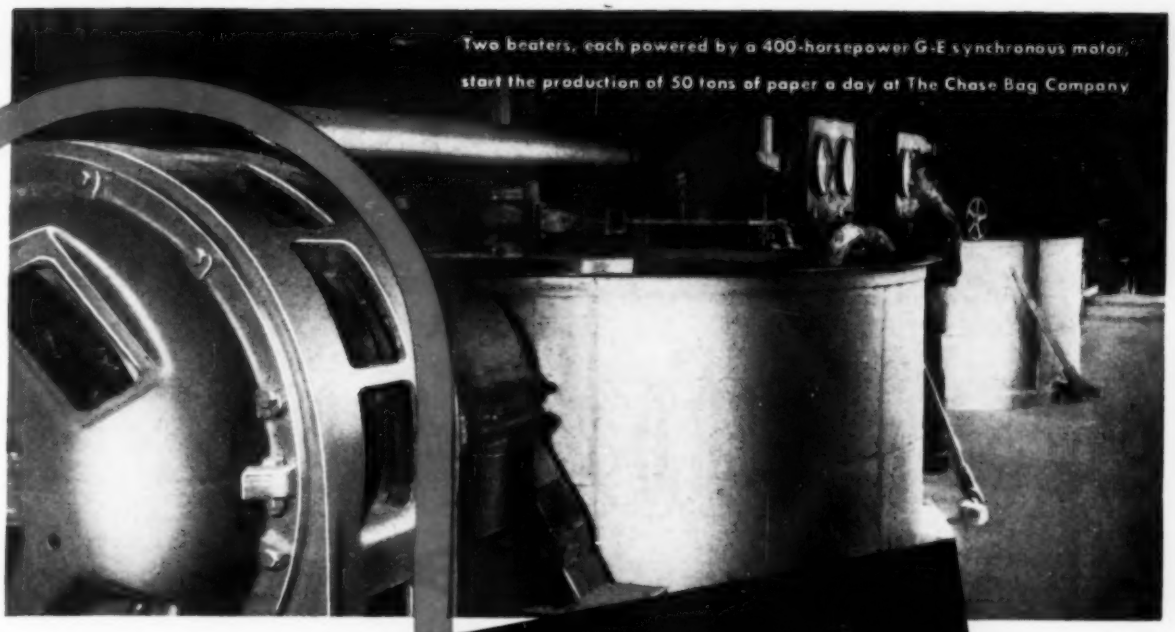
CHEMICAL ENGINEERING'S READER SERVICE COUPON
330 West 42nd Street New York 18, N. Y.

How to Use These READER SERVICE COUPONS

● Be sure to fill out completely a separate coupon for *each* new product or equipment item on which you want more information and for each piece of literature you wish sent you. Reader Service will then forward them to the proper sources provided you have supplied the necessary information.

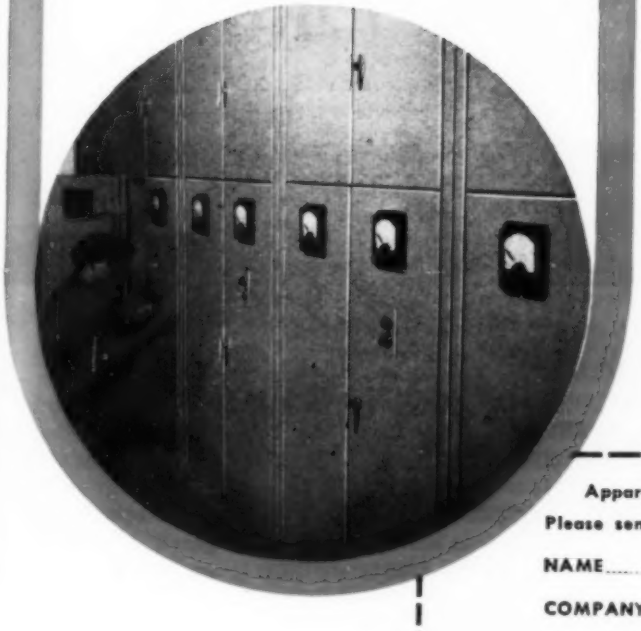
When you have filled out completely the coupons required for each request, detach the post cards, and drop in the mails.





Two beaters, each powered by a 400-horsepower G-E synchronous motor, start the production of 50 tons of paper a day at The Chase Bag Company

protected... BY GE LIMITAMP



1900 horsepower's worth of paper production

At the Chase Bag Company's Chagrin Falls mill, two beaters, two Jordans, and a Fourdrinier paper machine are powered by G-E synchronous motors and a 10-unit m-g set controlled and protected by five G-E Limitamp controllers. These machines produce 50 tons of paper a day, and loss of a day's production cannot be recovered in a month or even a year if a breakdown occurs. It's important to prevent electrical disturbances resulting from short circuits—and that's where G-E Limitamp proves its worth.

Advantages for you, too . . .

In 1/120 of a second Limitamp operates to prevent the spread of short-circuit damage. These controllers are not only quick acting (because of special EJ2 fuses), but the contactors are especially designed to stand up under several million operations—providing much longer life than is usually possible for such high-voltage equipment. Limitamp is also applicable for semi-hazardous or corrosive atmospheres.

Apparatus Dept., Section D676-260, General Electric Co., Schenectady 5, N. Y.
Please send me your publication GEA-4247 describing the Limitamp controller.

NAME .....

COMPANY .....

ADDRESS .....

GENERAL ELECTRIC

CSC MAMMOTH CHEMICAL CIRCUS

with

PANOPLY

and

PROPER PRIDE

CSC

presents

THE PREPOTENT CHEMICAL OF THE MONTH

A STELLAR

SURFACE-ACTIVE AGENT OF
SUPERLATIVE SUPERBITY AND
STAGGERING SCOPE

ALKATERGE-C

Properties:

Molecular and Equivalent Weights: 350, approx.

Specific Gravity at 20° C/20° C: 0.93 (7.77 lb/gal)

Weight per U.S. Gallon . . . 7.77 pounds at 20° C.

Distillation range at 3 mm of Mercury: 194° C to 310° C

Solubility in: Water—Less than 0.002% by weight; Mineral and Vegetable Oils—Miscible; Organic Solvents—Miscible with naphtha, benzene, kerosene, carbon tetrachloride, ethyl acetate, acetone, methanol, butanol, and most other organic solvents.

Surface Tension of Saturated Aqueous Solution: Less than 35 dynes/cm

Interfacial Tension Against Water of a 1% Solution in Mineral Oil: 1 to 2 dynes/cm

Heat Stability: No apparent decomposition on distillation to 430° C at atmospheric pressure

Solidification Point: — 36° C, approx.

Coefficient of Cubical Expansion (20° C to 30° C): 0.0008 per 1° C; 0.0004 per 1° F

Flash Point (Cleveland Open Cup): 430° F

Uses:

ACID ACCEPTOR for non-aqueous systems

USEFUL as an ingredient of corrosion-preventive oils

A PENETRANT in textile and paper manufacturing

RECOMMENDED as an assistant for grinding hydrophillic pigments in mineral oil

A VERY EFFECTIVE oil-soluble surface-active agent

VALUABLE as an auxiliary emulsifying agent

REDUCES RESIN CONSUMPTION in impregnation of paper

Test Alkaterge-C on your own chemical problem—additional data and sample quantities are yours for the price of a postage stamp!

COMMERCIAL SOLVENTS
CORPORATION
17 East 42nd Street, New York 17, N. Y.

CSC

NEW PRODUCTS AND MATERIALS

Joseph A. O'Connor, ASSISTANT EDITOR

Cleaning line for high-carbon wire at Jones & Laughlin's Aliquippa, Pa., mill, where the rust inhibitor Banox is used. The wire is reduced to fine gage after treatment.

51. Rust Inhibitor

AN AMORPHOUS metaphosphate compound, known as Banox, manufactured by Calgon, Inc., of Pittsburgh, is now being used by Jones & Laughlin Steel Corp. at its Aliquippa, Pa., wire mill to inhibit rust and to lubricate wire in process. It permits a 20 to 25 percent increase in speed of drawing fine high-carbon wire.

Coating deposited by a Banox solution, the manufacturer reports, is an amorphous or non-crystalline phosphate with a physical structure much like that of high-polymer resins. It follows the profile of the metal surface in an even and continuous film about 0.000015 in. thick, imparting no roughness and retaining its flexibility so that it does not crack or flake in further processing of the wire or other metal product or part. Heat is not required for application; nor is special equipment. Both spray and immersion methods are being employed. A maintenance problem common to coating with most phosphate solutions is eliminated because a solution of Banox does not produce a sludge in the tank.

Cost per ton of wire for use of the new material varies with the diameter of wire being rust-proofed. It is usually from 15 to 35c. per ton of wire treated.

This is the first application of Banox to wire-drawing. It has been effectively employed as a rust-proofing and paint-bonding coating used before painting. Makers of household appliances, metal furniture and automobile bodies and parts have used it for this purpose.

52. Penicillin Drug

A MORE convenient dosage form of penicillin which permits treatment of patients for four days with a single injection has been announced by Sharp & Dohme, Inc., Philadelphia drug firm. Pazillin, as it is called, doubles the duration of action for a single injection of penicillin which was previously obtainable with plain procaine penicillin in oil.

Addition of aluminum stearate, a water-repellent compound, is responsible for Pazillin's prolonged therapeutic effectiveness. By jelling the oil in which the penicillin is suspended, this compound slows the rate at which the penicillin enters the blood stream from the muscle of the patient. In clinical studies, 90 percent of more than 100 patients to whom one injection (300,000 units) of Pazillin was administered showed therapeutic blood levels for 96 hr. or more.

This product is a sterile, free-flowing, uniform liquid prepared from nonpyrogenic crystalline procaine penicillin G monohydrate. Each cc. contains 300,000 units suspended in peanut oil with aluminum stearate. These 300,000 units contain the equivalent of 120 mg. of procaine base. Pazillin is supplied in 1-cc. B-D disposable cartridge syringes and in 10-cc. multiple-dose vials.

CONTENTS

Rust Inhibitor	185
Penicillin Drug	185
One-Coat House Paint	185
Polystyrene Plastic	186
Rubber Softener	188
Vinyl Copolymer	188
Plasticizer for Vinyls	190
Quick-Setting Glue	190
Greenhouse Aerosols	192
A Trio of Glycols	192
Flame- and Moth-Proofing Compound	194
Coconut-Base Detergent	196
Potent Local Anesthetic	196
Two Antioxidants	198
Dyestuff Intermediate	200

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

53. One-Coat House Paint

IT IS now possible, according to Devoe & Raynolds Co., to repaint a house and to create a white film with just one coat. This can be done with Devoe One-Coat House Paint, a product that has been successfully field-tested for close to four years, during which time 1,861 American homes have been repainted with it.

Field and service tests have indicated high resistance to peeling and scaling, and a minimum of discoloration. The paint provides a long lasting clean white film, which is self-cleaning due to a gradual chalking of the finish. Because of economy in time and labor,

CHOOSE CLARK
All down the line

A NEW TRAP JOINS A FAMOUS LINE ---

Clark Traps

INTRODUCING THE NEW CLARK "60"

Series "80" Inverted Bucket Steam Trap

"CRV" Pressure Regulator

A small trap with big trap features. Positive seating with guided disc. Equipped with *two inlets* and *two outlets* for easy installation for horizontal, vertical or angle connections.

Let Clark's 40 years of experience be your guide in selecting the proper trap or valve for your drainage needs.

Series "70-T" Inverted Bucket and Blast Steam Trap

Write today for complete story on Clark Traps and Valves.

Series "70" Inverted Bucket Steam Trap

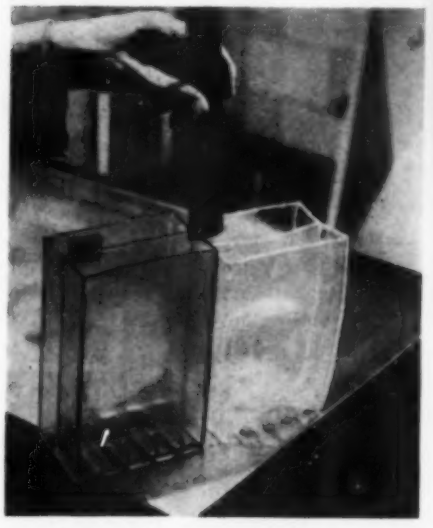
THE CLARK MANUFACTURING CO.
1833 EAST 38th STREET • CLEVELAND 14, OHIO

Clark

TRAPS — FLOAT, INVERTED BUCKET, OPEN BUCKET AND VACUUM • REDUCING VALVES • STRAINERS

as well as in material, operators of housing developments, repainting many dwellings at a time, report savings on their painting jobs.

Its ability to stand out as an even film over a previously painted surface and its tremendous opacity due to a great number of paint-hiding units are the outstanding features of the new one-coat house paint. Pigments comprise 66.1 percent of the paint, and vehicle makes up 33.9 percent of its composition. The pigment contains 8.5 percent of titanium dioxide, 24.0 percent of zinc oxide and 67.5 percent of titanium calcium pigment. A breakdown of vehicle composition shows 75.5 percent of processed vegetable oils, 20.3 percent of petroleum thinners and 4.2 percent of dryers.



Container (left) made of P-8, Koppers low-shrinkage polystyrene, withstood 10-min. immersion in boiling water much better than case made of general-purpose polystyrene. Both were the same size before this boiling test at Mellon Institute.

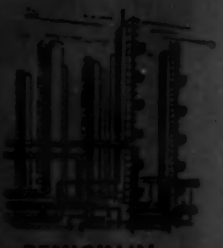
54. Polystyrene Plastic

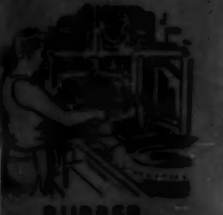
KOPPERS-Polystyrene P-8, a new high heat-resistant, low-shrinkage polystyrene plastic, developed by the Chemical Division of Koppers Co., Inc., is expected to open new fields for this important material.

P-8 embodies three important characteristics not previously attained in materials of this type: (1) it can be molded into a glass-clear product as well as in all colors; (2) it molds as easily as regular grades of polystyrene, whereas previous high heat-resistant polystyrenes have presented many molding problems; (3) when made in colors, the new material resists fading even when submitted to extended submersion in boiling water.

A new process makes it possible for Koppers to produce and sell P-8 with-

PUT THE PLUS IN YOUR PROCESS!





HEYDEN CHEMICALS

For Control of Quality...

When Heyden Fine Chemicals are your standard allies for formulation and synthesis, products are given that *PLUS value* so important to quality and sales appeal. And by PLUS value, we mean Heyden's assurance of:

. . . Constant source of supply.

. . . Production control through uniformity.

. . . Exacting specifications—assured quality.

. . . Extensive facilities of 5 modern plants.

Heyden's ceaseless research and far-reaching technical know-how are always at your command . . . to help put that PLUS in your process or product.

Serving Industry Through Finer Chemicals

HEYDEN CHEMICAL CORPORATION

393 SEVENTH AVENUE, NEW YORK 1, N. Y.

Chicago Office: 20 North Wacker Drive

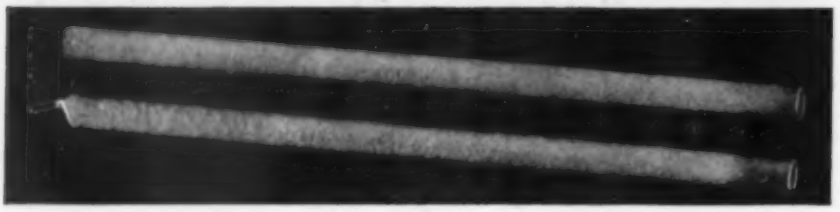
Philadelphia Office: 1700 Walnut Street

FINE HEYDEN CHEMICALS

Benzaldehyde • Benzoates • Benzoic Acid • Benzyl Chloride Bromides • Chlorinated Aromatics • Chlorobenzenes • Creosotes Formates • Formaldehyde • Formic Acid • Glycerophosphates Guaiacols • Hexamethylenetetramine • M. D. A. (Methylene Disalicylic Acid) • Paraformaldehyde • Parahydroxybenzoates • Penicillin Pentaerythritols • Salicylates • Salicylic Acid • Streptomycin

© 1948, Heyden Chemical Corporation

AMERSIL* SILICA COMBUSTION TUBES



withstand severe thermal shock, are non-contaminating, and may be used continuously at temperatures up to 1100° C. They may be further used for short periods at temperatures up to 2000° C. They are inert to all metals and metal oxides, and impervious to gases.

Amersil combustion tubes are available in standard sizes, or special sizes on short notice, with ends finished for rubber stoppers or one end reduced for hose connection.

WHEN REQUIRED — tubes can be fitted with transparent sections

COMBUSTION BOATS — Transparent or translucent are available

FOR ACCURATE READINGS — Thermocouple wells can be included

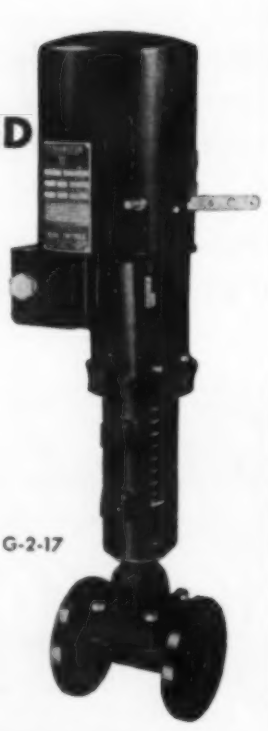
Write to-day for more complete information on Amersil combustion tubes.

*Trade Name Registered.

AMERSIL COMPANY Inc.

CHESTNUT AVENUE ENGELHARD HILLSIDE 5, N. J.

Saunders TYPE HYDRAMOTOR OPERATED VALVES



G-2-17

GENERAL CONTROLS G-2-17 and G-3-17 valves for the remote control of chemical solutions, acids and pulpy liquids where a slow opening automatic valve is required.

Hydramotor operator has no gears, direct-connected motor-driven pump develops *hydraulic* pressure for direct action against an alloy spring loaded valve stem and seating diaphragm.

The entire hydramotor operator is *sealed in oil for life* to assure constant lubrication, reduction of wear, freedom from dust, grit, and other foreign matter thus insuring trouble-free operation and reduced maintenance costs. Valves have simplified two-wire control circuits, automatically go to closed position on current failure.

FOR COMPLETE SPECIFICATIONS request new Catalog.

GENERAL CONTROLS

FACTORY BRANCHES: — Birmingham (3), Boston (16), Chicago (5), Cleveland (15), Dallas (2), Denver (10), Detroit (8), Glendale (1), Houston (2), Kansas City (2), New York (17), Philadelphia (40), Pittsburgh (22), San Francisco (7), Seattle (1), Oklahoma City (1).

DISTRIBUTORS IN ALL PRINCIPAL CITIES

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

out charging a premium price. All previous high heat-resistant polystyrenes have sold at a premium above the price of regular polystyrenes.

The new P-8 will probably not replace regular grades of polystyrene for uses where no special resistance to heat is required. Instead, the plastic material will be used in new fields. Koppers P-8 seems to be well suited for molded knife and fork handles, funnels, tea strainers and other household utensils subjected to the scalding water of automatic dish washers; for bright colored radio cabinets resistant to heat from radio tubes; for storage battery cases which must not shrink under the heat of operation; and for most uses where crystal clarity is required in combination with high heat-resistance. It also has excellent possibilities in the electrical field.

55. Rubber Softener

A NEW rubber softener has been developed by the Witco Chemical Co. Witco No. 30 is a petroleum-base softener with a viscosity of approximately 90 sec. Saybolt Furol at 122 deg. F. compared to about 500 to 800 sec. for the older, more viscous softeners. Low viscosity in a rubber softener means greater convenience of handling in the factory and a saving in time and labor. Physical properties imparted to rubber by Witco No. 30 are equal or superior to those obtained with other high-viscosity softeners.

56. Vinyl Copolymer

Now being used in the actual production of finished materials is Pliovic, a novel vinyl copolymer. The resin is being made available to the plastics industry by the Chemical Division of the Goodyear Tire & Rubber Co. Processing advantages of Pliovic have aroused interest in the fabricating trade.

Pliovic displays the inherent toughness characteristic of high vinyl copolymers. But its chemical nature is such that it actually requires less plasticizer and is easier to process than most of the similar high-molecular-weight materials now on the market. In addition, it has been found that Pliovic can be utilized to produce organosols

ADAMS
RUBBER LINED (CFR) AND LEAD LINED (CFL)
FILTERS

For High-Degree, Crystal-Clear Filtering of Corrosive Chemicals

- Clarification of industrial acids and corrosive liquids.
- Continuous Flow or batch operation.
- Removal of solids from liquids where the reclamation of the cake is not essential.

WITH

PORO-STONE

AND

PORO-CARBON

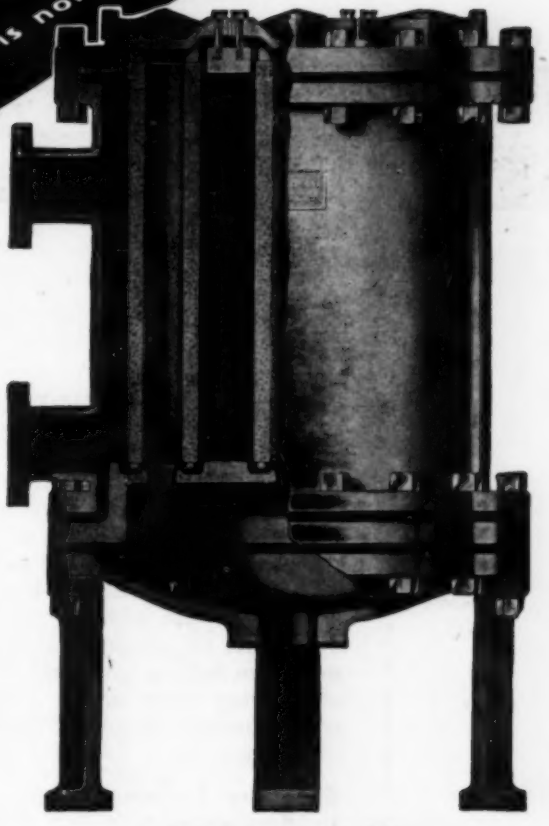
FILTER MEDIUM

INERT... Resists action of acids and alkalies.

PERMANENT... Eliminates filter medium replacement.

RIGID... Permits pressure filtering and backwashing.

HIGH DEGREE FILTRATION... Obtainable in various porosities.



TYPE CFL and CFR

1. **Totally enclosed.** Especially safe for handling hazardous liquids, as dismantling for cleaning is not necessary.

2. **Cleaned by Backwashing**... the Adams *surge tank* method. Filtered liquid under pressure is forced through the filter in reverse flow, thoroughly cleaning the pores in a few seconds.

3. **Complete Liquid Recovery.** Valuable liquids filtered completely and withdrawn before backwashing.

4. **All contact surfaces lined** to resist action of corrosive liquid.

WRITE FOR BULLETIN

for full information on construction and operation of CFL and CFR Type Filters.

R. P. ADAMS CO., INC.

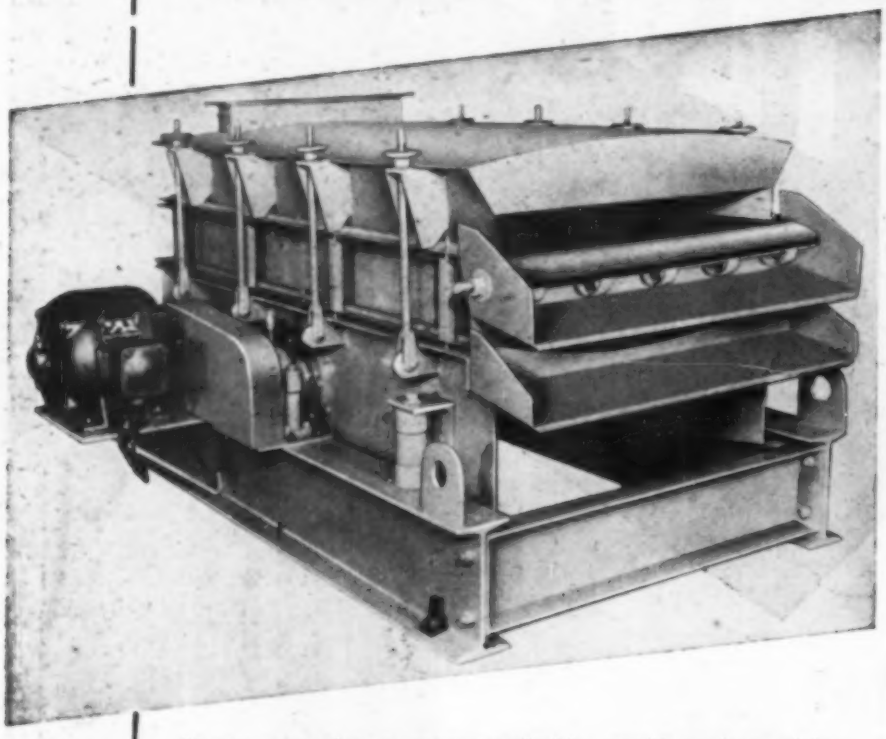
207 EAST PARK DRIVE

BUFFALO 17, NEW YORK

REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

100% SANITARY

simplicity gyrating screens speed sizing and dewatering of chemical products



If you want faster, more profitable, 100% sanitary sizing and dewatering of materials in your processing, it will pay you to investigate Simplicity Gyrating Screens. They handle a wide variety of materials and greatly increase production through the efficient Simplicity gyration. For example, in a starch plant a 2-tray Simplicity screen with 150 mesh cloth screens 180 gallons of starch fluid per minute. In a soap plant, a 4′ x 8′ Simplicity Single Deck Screen equipped with $\frac{1}{16}$″ slotted opening cloth can screen 31,256 lbs. of powdered soap per hour, with no blinding, minimum balling, and only 4% tailings. Many plants are eliminating their stream pollution problems by passing waste through Simplicity Screens to remove solids before dumping.

Simplicity Gyrating Screens for the chemical products industry are made with 1, 2, 3, and 4 trays that are easily accessible for cleaning. There are no hidden corners or obstructions to collect dirt. Discharge spouts may be open or totally enclosed. Mild steel, 188 stainless, or 316 stainless steel construction. Send us particulars of your sizing and dewatering operations and our engineers will recommend specific Simplicity equipment that will do more and better work for you in less time and at lower cost.

Simplicity
TRADE MARK REGISTERED
Engineering Company Durand, Mich.

FOR CANADA:
CANADIAN BRIDGE
ENGINEERING CO. LTD
WALKERVILLE, ONTARIO

which fuse with less heat than average, and can produce films which heat-seal at lower temperatures.

The new resin is supplied as a white granular powder which is odorless and tasteless. The powder does not support combustion. Many possible applications are suggested by its toughness, abrasion resistance, high strength, pleasing appearance and good processing qualities. Already the resin is being used in calendered film and flooring; it is being employed in extruded tubing and hose; and it is used as an organosol in dipped goods and coated fabrics.

This vinyl copolymer is available in two grades, Pliovic A for general use and Pliovic AO for organosols. It is planned that the resin will be the parent of a new family of vinyl chloride copolymers.

57. Plasticizer for Vinyls

LATEST addition to the line of plasticizers manufactured by Emery Industries of Cincinnati, Ohio, is Plastolein 9715. The new plasticizer is described as a resinous plasticizer especially suitable for the vinyls, where low volatility and low oil extraction are of major importance. Now available in commercial quantities, Plastolein 9715 has also been found to be especially effective in polyvinyl acetate formulations.

58. Quick-Setting Glue

AS A SERVICE to the wood industries, the Timber Engineering Co., Washing, D. C., has introduced a new adhesive for both hardwood and softwood known as Colpres 10. The new urea-resin adhesive sets in 10 min. at room temperature.

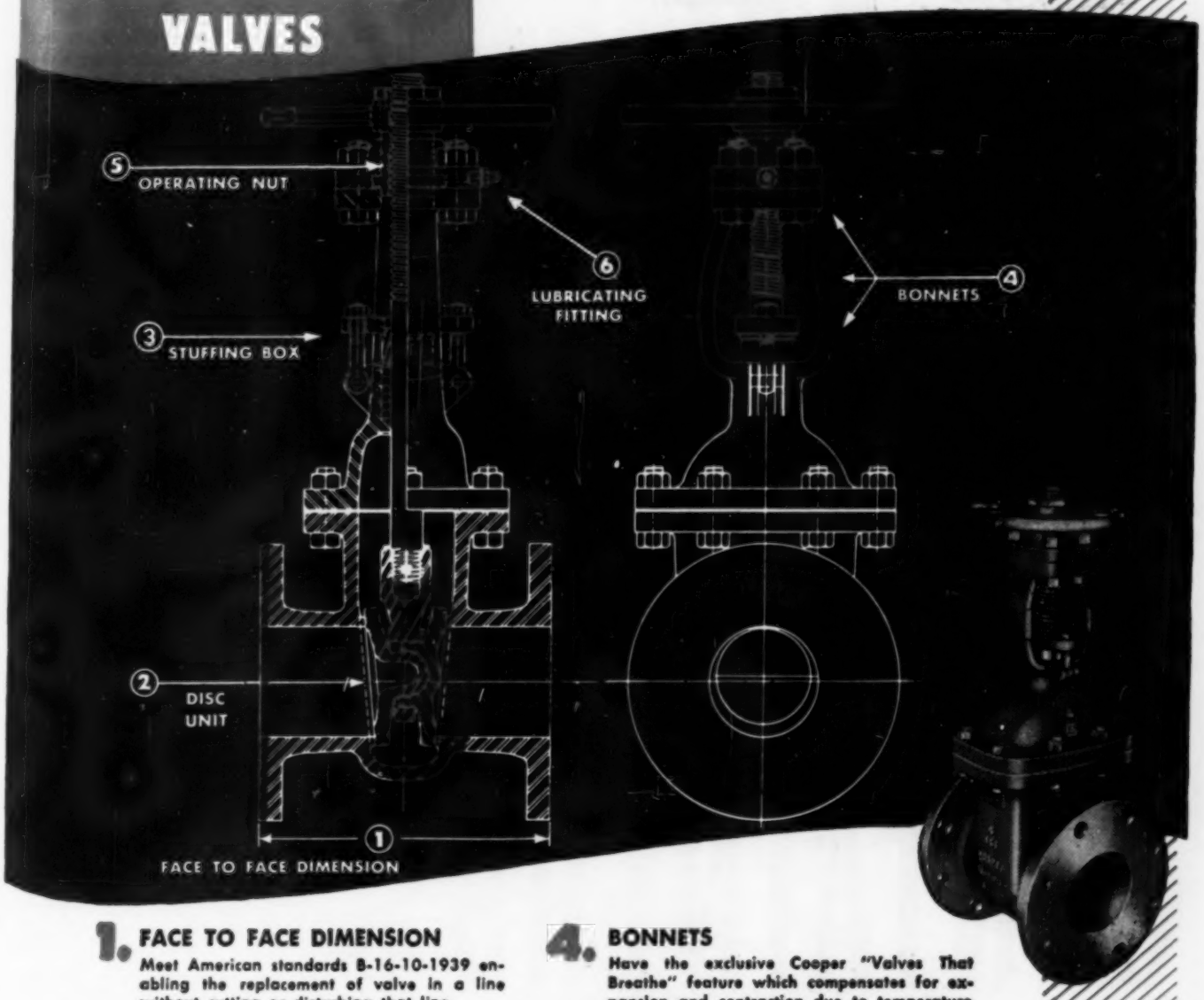
Colpress 10 is a two-part adhesive consisting of a dry powder formaldehyde resin which is mixed with water and applied to one of the wood surfaces to be glued, and a liquid hardener which is applied to the other surface.

Furniture manufacturers and other users will require no new, expensive equipment in using this adhesive. It sets at room temperature (75 deg. F.) and the setting time is so responsive to temperature changes that the speed of cure can be easily adjusted to production-line requirements. Parts glued at room temperature are ready for machining in ten minutes. By preheating the wood to which the resin is applied to 180 deg. F., a clamping time of 2 min. may be used. The glue is water-resistant, non-staining and of great strength.

Shear strength developed in 10 min. at room temperature is approximately

COOPER CERTIFIED STAINLESS STEEL VALVES

have these unique design features



1. FACE TO FACE DIMENSION
Meet American standards B-16-10-1939 enabling the replacement of valve in a line without cutting or disturbing that line.

2. DISC UNIT
Adjusts itself to the seats in the valve body regardless of angle. Positive sealing insured on the upstream or downstream sides of the discs.

3. STUFFING BOX
More adequate in depth to insure tightness and maximum packing life.

4. BONNETS
Have the exclusive Cooper "Valves That Breathe" feature which compensates for expansion and contraction due to temperature changes without damaging the stem or operating nuts.

5. OPERATING NUT
"Replaceable Operating Nut" eliminates line shut down or breaking of Bonnet Joints.

6. LUBRICATING FITTING
Feeds lubricant to operating nut insuring ease of operation.

Sold thru Leading Stainless Steel Distributors

THE COOPER ALLOY FOUNDRY CO.
HILLSIDE, NEW JERSEY
Specialists in Corrosion Resisting Stainless Steel . . . for a Quarter of a Century

INLAND STEEL CONTAINERS

lead the industry with experience in fabrication, originality in design, extensive material resources and facilities.

INLAND STEEL CONTAINER CO.

Container Specialists

6532 S. Menard Avenue
Chicago 38, Illinois

PLANTS AT: CHICAGO • JERSEY CITY • NEW ORLEANS

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

500 psi. Ultimate strength is reached in about 24 hr., at which time shear strengths approaching 4,000 psi. are not uncommon, using dense hardwoods. Joints glued with Colpres 10 retain high initial strength. Tests on two-year old shear blocks show no deterioration with age.

59. Greenhouse Aerosols

Two gas-propelled aerosols for use in greenhouses are now being produced by Eston Chemicals, Inc., of Los Angeles. One of these aerosols is Aerofume-T, which contains 5 percent of Tetron. Tetron is a technical-grade tetraethyl pyrophosphate. The other aerosol is Aerofume-A, which contains 10 percent of Alkron. Alkron is technical parathion.

Anhydrous methyl chloride is employed as propellant for these aerosols, thereby eliminating the hydrolysis and breakdown inherent in steam-generated aerosols. Aerofume is ready for use without the addition of other chemicals, water or heat.

The Aerofume formulas are designed to control most common greenhouse insect pests including: aphids, red spiders, whiteflies, mealy bugs and some scale insects. Application of greenhouse insecticides by the aerosol method is a simple, speedy and most economical operation. Each cylinder will treat the equivalent of four greenhouses with a capacity of 100,000 cu.ft. each.

Eston Chemicals, Inc., is a basic producer of tetraethyl pyrophosphate and parathion, as well as the methyl chloride which is used as the propellant, and therefore is in a position to assume unified responsibility for production. All manufacturing and filling operations are performed under close control, and ample stocks of materials and cylinders are available for prompt delivery.

60. A Trio of Glycols

Carbide & Carbon Chemicals Corp. has announced commercial production of three new glycols. These are butanediol-1,3; 2-methyl pentanediol-2,4; and octylene glycol.

This is the first commercial production in the United States of

SOLVENT EXTRACTION

by

Vulcan

flexible..
efficient..
economical

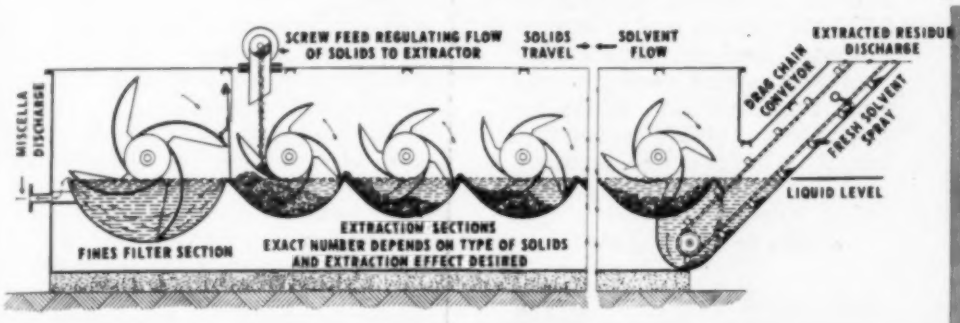
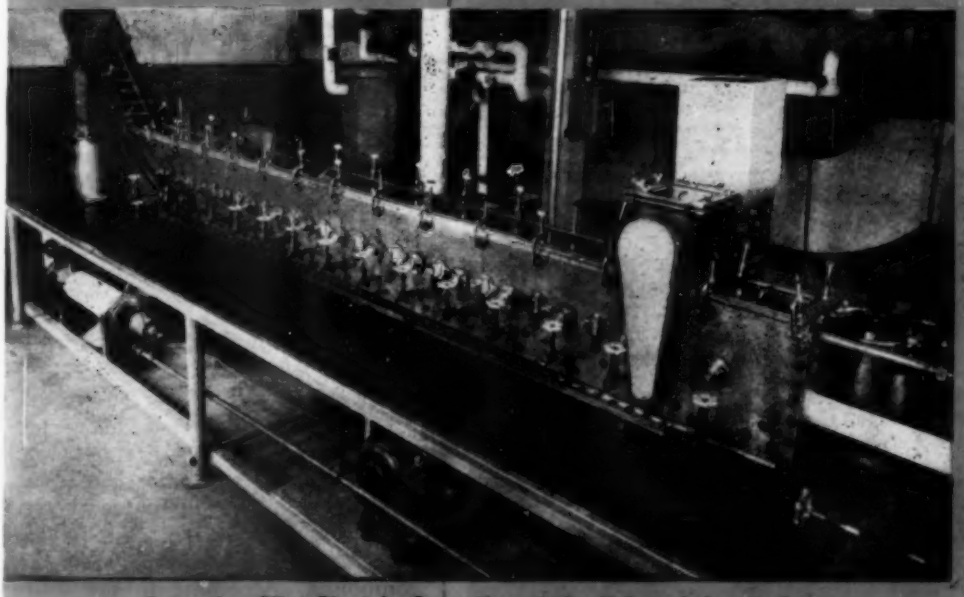


Diagram of the "Kennedy" Patented Continuous Solvent Extraction System.



Extraction Pilot Plant in Operation at the Vulcan Laboratories.

Vulcan's careful engineering design based on years of experience and data from laboratory, pilot plant, and commercial installations can solve your solid-liquid extraction problem. Cotton seed, cocoa bean residues, tung kernels, packing house waste, soybean flakes, rice bran, oil press cakes, along with materials producing vegetable dyes and tanning extracts have been efficiently extracted. Rotating propellors, often moving as slowly as 10 revolutions per hour, assure thorough extraction: first, by *dispersing*; second, by *completely immersing*; third, by *slightly compressing*; fourth, by *draining* the solids as they move through each section of the extractor in counter-current flow to the solvent. Elimination of all but a very minimum of fines in the concentrated extract liquor is accomplished by the *filtering* action of the solids on the solvent as they move between the sections, and also by the *settling* action of each of the sections, especially in the filter section. Extraction washing and leaching operations have been conducted with many types of solvents such as Hexane, Heptane, Chlorinated Hydrocarbons, Alcohols, Acids, and Water.

Vulcan's time-tried and proven distillation equipment for low temperature separation of the solvent from the extracted oil can be utilized in conjunction with the extractor.

PILOT PLANT

PROCESS DESIGN

MECHANICAL DESIGN

SHOP FABRICATION

FIELD ERECTION

INITIAL OPERATION

For half a century Vulcan has furnished the processing industry, both in this country and abroad — with complete chemical plants and specialized distillation, evaporation, and extraction equipment. Laboratory and pilot plant facilities are constantly employed to back up the practical experience and technical knowledge of the Vulcan engineers and fabricators.

Vulcan

distillation
evaporation
extraction
processes and equipment

THE VULCAN COPPER & SUPPLY CO., General Offices and Plant, CINCINNATI, OHIO
SAN FRANCISCO NEW YORK BUENOS AIRES

IN CANADA — VICKERS VULCAN PROCESS ENGINEERING COMPANY LTD. — MONTREAL

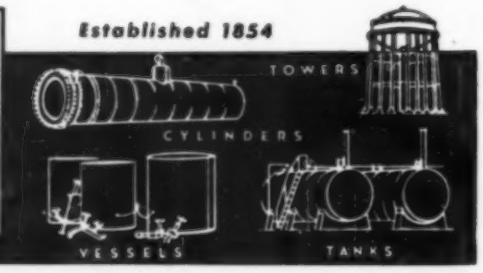
TOPS IN TANKS

• Scores of cities and industries rely on Cole elevated tanks for dependable water service and constant pressure. Available in capacities of 5,000 to 2,000,000 gallons and in a wide range of designs. Our skilled engineers stand ready to fill your requirements. Write for quotations, giving capacity, height to bottom, and location.

Write for latest Cole catalog — "TANK TALK"

R. D. COLE MANUFACTURING CO.
NEWNAN, GA.

Established 1854



DRYERS — DRYERS — DRYERS

STANDARD Rotary dryers are used throughout the world. STANDARD dryers are competently engineered and sturdily built in a wide variety of types and sizes for drying various products, such as fish meal, garbage, tankage, humus, fertilizer, sewage, sludge, agricultural products and countless chemicals. Stock designs available in sizes of 2 feet to 10 feet diameters. Let our engineers help you with your problems —regardless of your location.

We welcome your inquiries.

STANDARD STEEL CORPORATION
Engineers—Manufacturers

5001 Boyle Avenue Los Angeles, Cal.

butanediol. This is a mild-odored, colorless liquid, miscible in all proportions with water and alcohol. It is less volatile and more viscous than its lower homologs, ethylene glycol and propylene glycol. The hygroscopicity of butanediol is about 60 percent that of glycerine and three times that of octylene glycol. Its derivatives are less water-soluble and more soluble in hydrocarbons than those of ethylene glycol.

Methyl pentanediol is a colorless liquid with a mild hygroscopicity, retaining a constant moisture content over a wide range of humidity. It is miscible with water; the lower alcohols, ethers, ketones and esters; chloroform; and ethylene dichloride.

Octylene glycol is a colorless 1,3-diol of low volatility and limited water solubility. It is the first commercially available glycol having limited water solubility. Its viscosity is much greater than that of the lower diols, but less than that of glycerine. It is about one-tenth as hygroscopic as glycerine at 65 percent relative humidity and at 21 deg. C.

These new glycols are good plasticizers and softeners for animal glues, casein, coarse gelatin, polyamide resins and zein compositions. They are useful as coupling or blending agents for cosmetic creams and metal-cutting, leather and textile oils, and as solvents for essential oils, natural gums and resins. They are also employed as intermediates for alkyd resins and plasticizers for synthetic resins.

61. Flame- and Moth-Proofing Compound

UNIQUE product now being produced in limited quantity by Gagel Laboratories, Inc., of Dayton, Ohio, is a compound that protects fabric from moths and flames. It took eight years of research to develop the new compound. According to the manufacturers, there is no other product now on the market that protects a fabric from both moths and flames.

The principle involved is the impregnation of the cloth with a chemical that reduces the oxygen supply and makes combustion more difficult.

A piece of cloth treated with Flamoth, as it is called, will not burst into flame when a lighted match is held directly against it. If the flame is applied steadily and if it is intense enough, of course, the fabric will burn. But it does not burst into flame. It merely chars and the fire goes out as soon as the flame is removed.

The protection remains for one year when Flamoth is sprayed on a garment, rug, curtain or drape, its pro-

Permutit's WATER BARGAIN!

Slash costs up to 95%

Replace high-priced distilled water with Permutit's low-cost demineralized water

Compare costly, sparingly used distilled water with Permutit's Demineralized Water . . . it's up to 95% cheaper . . . it's a bargain that's good for nearly as many uses as distilled.

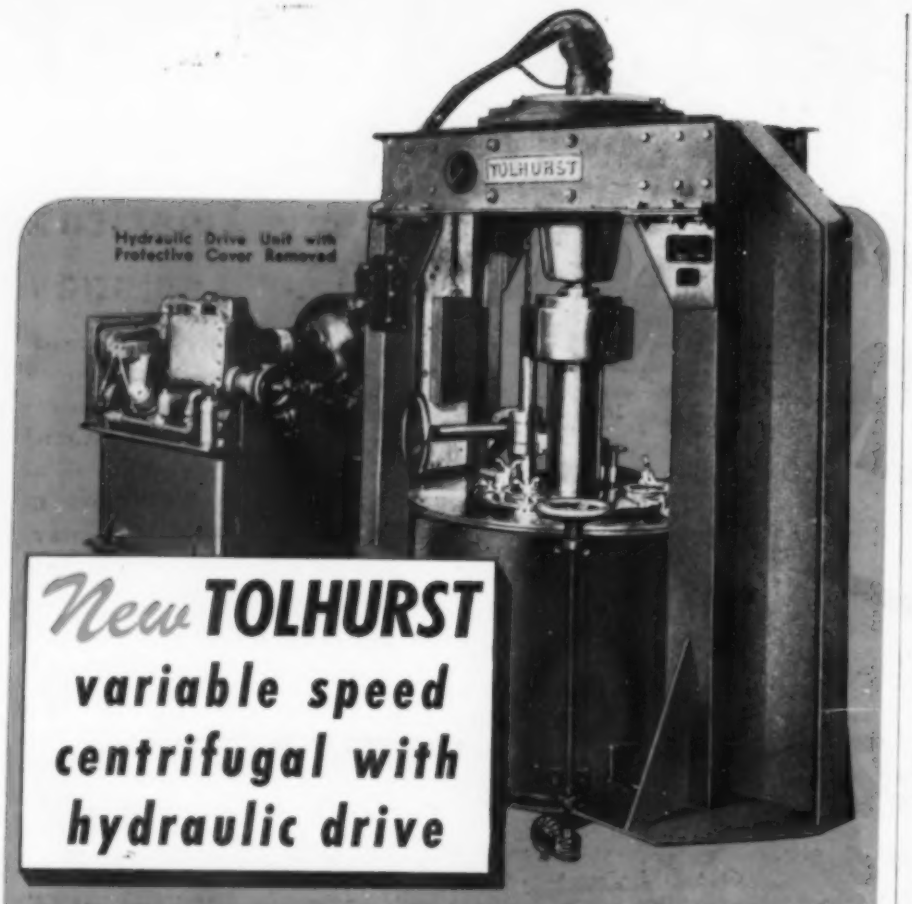
In Permutit's Demineralizing process, Zeo-Karb H*, Permutit's acid regenerated organic cation exchanger, replaces metallic cations in the water with hydrogen ions, converting the salts present into corresponding acids. These acids are then removed from the water by De-Acidite*, a resin type anion exchanger.

For full details on this economical demineralized water write to The Permutit Company, Dept. CE-11, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

Permutit

WATER CONDITIONING • ION EXCHANGERS • MATERIALS & EQUIPMENT



New **TOLHURST variable speed centrifugal with hydraulic drive**

IDEAL FOR LABORATORIES AND PILOT PLANTS

Meet the new Tolhurst Variable Speed Centrifugal, the only machine of its type with variable speed hydraulic drive and hydraulic braking. Smooth, stepless speed variation ranges from 0 to 2150 RPM, with centrifugal force range up to 1700 times gravity. Overload protection is inherent in the drive; machine can be stalled indefinitely under load without damage.

This new centrifugal is available with baskets — perforate or imperforate — 20" and 26" in diameter. Drop-bottom case provides easy interchangeability of baskets. Additional features include counterbalanced unloader and tachometer to indicate basket speed. Standard single speed squirrel cage motor can be open, totally enclosed fan cooled or explosion-proof, as specified. When required, this machine can be made completely fume-tight (as shown in illustration).

SPECIFY TOLHURST CENTRIFUGALS FOR SPEED AND CONVENIENCE IN

- Filtering
- Draining Solids
- Dehydrating Solids
- Clarifying Liquids
- Thickening Suspensions
- Separating Liquid Mixtures
- Separating Solids Suspended in Liquids

Write for **NEW CATALOG** ▶

Just off the press — this new attractive 16-page catalog showing Tolhurst Centrifugals for the Process Industries. Send for your free copy today.

Tolhurst Centrifugals

DIVISION OF AMERICAN MACHINE AND METALS, INC.
EAST MOLINE, ILLINOIS

Without obligation, please send new catalog, "Tolhurst Centrifugals for the Process Industries".

Firm Name_____

Street Address_____

City_____ Zone_____ State_____

Sender's Name_____

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

ducers claim. The fluid is colorless, odorless and stainless. It is applied as a fine spray through a mechanism that fits on the neck of the bottle. The protective quality is not destroyed by dry-cleaning.

62. Coconut-Base Detergent

A NEW coconut-base synthetic detergent called Hi-10 is made by Eureka Chemical Corp. of Los Angeles. Hi-10 is completely odorless and non-soluble.

The new detergent is manufactured by combining coconut oil with amines. The result is a pentavalent nitrogen compound in which the coconut fatty acids are combined with amines and amino-methyl compounds.

One large California shipper is now trying Hi-10 to remove odors from railroad refrigerator cars in which fruits and vegetables are shipped. The fact that the new detergent is odorless opens up many possibilities for specialized applications. However, Hi-10 can also be used for all general cleaning applications.

63. Potent Local Anesthetic

A PROMISING series of local anesthetics is being developed in the Research Division of Smith, Kline & French Laboratories, Philadelphia. Nine aminoalkyl ether derivatives of isoquinoline have been synthesized by a new method from a series of chloroisoquinolines not readily available heretofore. The basic structure, 1-(B-dialkylaminoethoxy)-3-alkylisoquinoline, was varied by substituting the alkyl group on the nitrogen and in the 3-position of the isoquinoline nucleus, from hydrogen through n-butyl.

Eight of the nine new compounds have been found to produce significant local anesthetic activity when tested on the cornea of the rabbit's eye, but outstanding activity has been found for the compounds having the smallest possible alkyl groups on the nitrogen and the largest alkyl group in the 3-position of the isoquinoline nucleus. This type of substitution makes the amino-bearing portion of the molecule relatively hydrophylic, while the 3-alkylisoquinoline portion takes on increased lipoid solubility. The importance of these factors in varying anes-

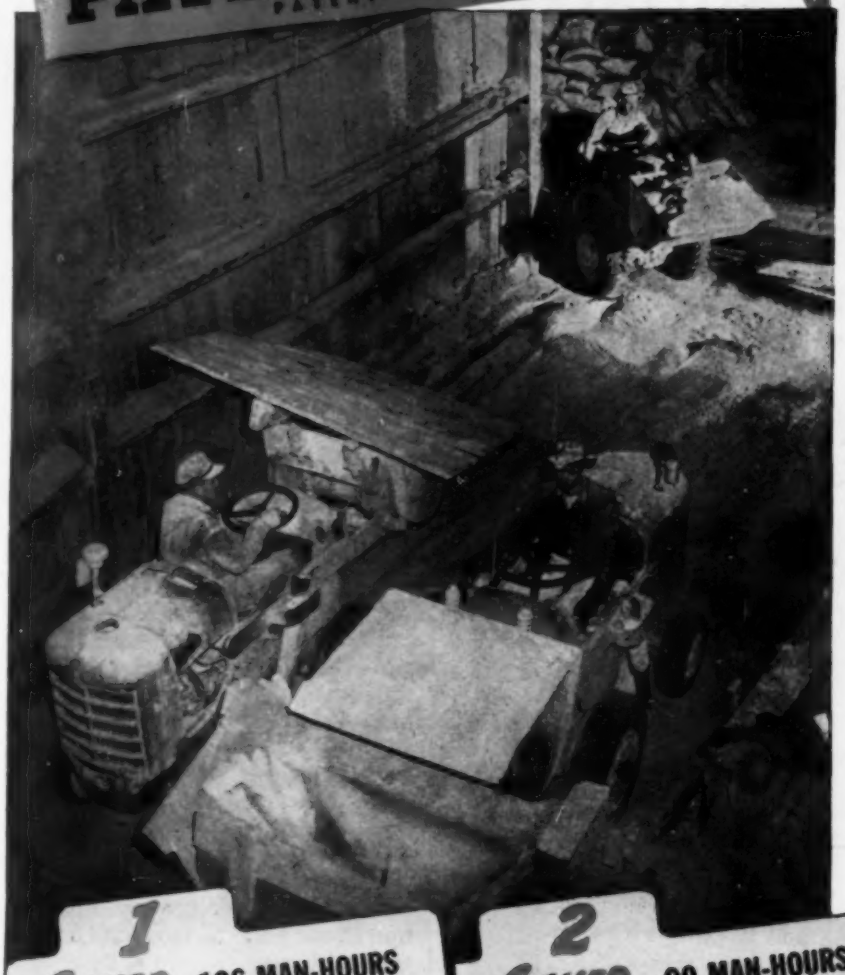
HOUGH
SAY "HUFF"
PAYLOADERS
PATENT

Pay 6 Ways!

at North American Fertilizer Company

When the management of this Louisville, Kentucky firm first saw Hough Model HA Payloaders working in another plant and learned that material handling costs were slashed from 60 to 8 cents per ton, they lost no time in buying several for their own plant. That was in 1944. Today they have six 10½ cu. ft. Model HA Payloaders that have paid for themselves many times over by savings in time, man-hours and production costs.

Payloaders go in and out of box cars and bins, up and down ramps, through narrow aisles . . . unload, load, transport and dump, spot cars . . . quickly and easily handle many laborious tasks. It will pay *you* to investigate the Payloader way for your own plant. Full information will be gladly supplied, without obligation.



1

SAVED...126 MAN-HOURS A DAY . . . Four Model HA Payloaders charge hoppers of bagging units . . . handle 50 tons per hour on a 200 foot round trip haul and save 126 man-hours per day.

2

SAVED...90 MAN-HOURS A NIGHT . . . Three Model HA Payloaders charge batching units each night . . . handle 50 tons per hour on a 200 foot round trip haul and save 90 man-hours per night.

3

SAVED...40 MAN-HOURS PER CAR . . . One Model HA Payloader unloads box cars of bagged ammonium nitrate, hauling 200 feet round trip. Saves 40 man-hours per car.

4

SAVED...36 to 45 MAN-HOURS PER CAR. . . One Model HA Payloader, when loading empty tobacco bags into box-cars, loads a car in one hour and saves 2 hours car demurrage time and 36 to 45 man-hours per car.

5

SAVED...17½ MAN-HOURS PER CAR . . . One Model HA Payloader unloads box cars of superphosphate, potash, sulphate of Ammonia and filler in 2½ hours on a 200 foot round trip haul. Saves 1½ hours time and 17½ man-hours per car.

6

SAVED...SPILLAGE LOSS These Payloaders also do general clean-up work around the plant, take up and reclaim hard-packed spillage which accumulates on the floors and aisles.

SEND TODAY for literature on the Model HA Payloader, 10½ cu. ft., the Model HF ¾ yd. and the Model HL 1¼ yd.; also the 2 cu. yd. Payloader Buggy.

THE FRANK G. HOUGH CO.

TRACTOR SHOVELS SINCE 1920

2000 SUNNYSIDE AVE.
LIBERTYVILLE, ILL.

A Low Cost GRIGNARD REAGENT

$$CH_3Cl + Mg \xrightarrow[dry]{ether} CH_3MgCl$$

with ANSUL Methyl Chloride

YIELDS—Excellent, better than 90%.

REACTION—Proceeds smoothly, rapidly, and is easily controlled. Can be carried on at atmospheric pressure and slightly above room temperature.

APPARATUS—Simple and inexpensive.

ANSUL CH_3Cl—Now a low cost chemical due to greatly expanded production facilities.

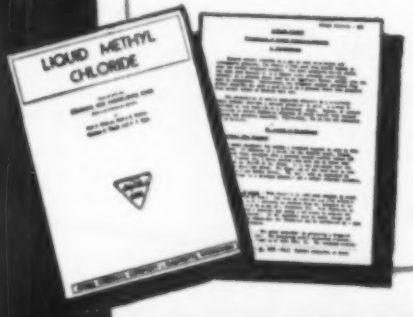
MAGNESIUM—Readily available and now relatively inexpensive.

CONCLUSIONS—Excellent yield, smooth reaction, inexpensive methyl chloride and magnesium . . . make a Low Cost Grignard Reagent.

LIQUID CH_3Cl by ANSUL®

PHYSICAL PROPERTIES

Chemical formula	CH_3Cl
Molecular weight	50.491
Color (gas or liquid)	Colorless
Odor	Ethereal, non-irritating
Melting point	−144° F. (−97.6° C.)
Boiling point	−10.65° F. (−23.7° C.)
Critical temperature	289.6° F. (143.1° C.)
Critical pressure	962.2 lbs. per sq. in. abs.
Solubility	Methyl chloride in water—3 to 4 volumes methyl chloride vapor in 1 volume of water at ordinary temperatures and atmospheric pressure—methyl chloride in alcohol—readily soluble
Specific gravity of liquid	.909



Send for Bulletin No. 900

"Preparing Methyl Grignard Reagent with Methyl Chloride" . . . and for "Liquid Methyl Chloride"—a treatise on the properties and general handling of Ansul Methyl Chloride.

® REG. U. S. PAT. OFF.

ANSUL CHEMICAL COMPANY
INDUSTRIAL CHEMICALS DIVISION, MARINETTE, WIS.
60 E. 42nd St., New York — 535 Chestnut St., Philadelphia

thetic properties is supported by the potent activity of the compound 1-(B-dimethylaminoethoxy)-4-butylisoquinoline (SKF 538-a).

Pharmacological studies at the Temple University Medical School have shown that a 0.01 percent solution of SKF 538-a produces anesthesia in the rabbit's eye that lasts 199 min. A similar solution of dibucaine produces anesthesia lasting 69 min., while 1 percent solutions of cocaine or procaine produce anesthesia lasting only 18 and 2 min., respectively. When toxicity studies, which are now in process, are completed, it is expected that SKF 538-a will be subjected to extensive clinical trials.

64. Two Antioxidants

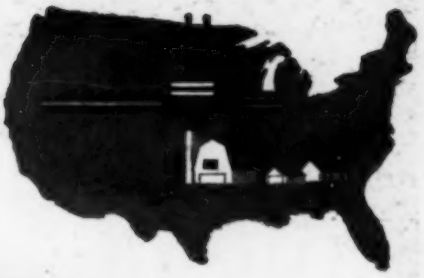
Two new antioxidants, Tenox HQ and Tenox BHA, have been developed by the Tennessee Eastman Corp. Added to fats and oils during processing, small percentages of Tenox HQ and Tenox BHA combat effectively the commonest type of rancidity, which is caused by the action of oxygen in the atmosphere. Indications are that these compounds, used separately or in combination, will stabilize fats and oils for almost every conceivable edible use, throughout the normal time of processing, distribution and consumption. Toxicity tests have shown these products to be safe for human consumption, when used in the prescribed proportions. They do not impair the nutritional value of food, and are economical to use.

Tenox HQ, a highly purified form of hydroquinone, is an effective stabilizer for salad oils, cooking oils, margarine, peanut butter, orange and lemon oil extracts, and dried milk. It is applicable to vitamin A oils, preventing loss of available vitamin A during storage.

Tenox BHA, chemically known as butylated hydroxy anisole, is of special value in stabilizing animal fats, particularly lard. Investigations by the American Meat Institute have shown that a combination of Tenox BHA and Tenox HQ, plus a synergist such as citric acid, provides an adequate answer to the stabilization of lard for all uses, including deep-fat frying of potato chips and doughnuts and the baking of crackers or pastry.

Heretofore, special antioxidants were lacking which could be produced in sufficient quantity and pure enough to be of interest to the fat and oil industries. The introduction of Tenox promises to fill this need. Through its use, fats and oils from many different sources can be more fully utilized, thereby stretching a tight supply of

CHASE *SERVES ALL INDUSTRY AND AGRICULTURE...*



MULTIWALL PAPER BAGS

Chase Multiwall Paper Bags

Chase Topmill Burlap Bags

Chase Lilipack

Chase Specialties

Chase Liners—Crinkled and Pleated

FOR more than one hundred years Chase has been manufacturing bags for industry and agriculture. This is important to you because our long and wide experience enables us to recommend the container that best combines efficiency and economy — whatever your product may be—dry or wet chemicals and compounds...soluble, granulated or solid products... fragile, durable or perishable products. Your Chase Salesman will be glad to tell you about the protective features of Chase's complete line of Better Bags... through the use of adhesives, coatings, and liners in connection with textiles and papers.

CHASE ENGINEERING

Chase engineers, chemists, and technically trained bag salesmen have been responsible for many new packaging achievements during the past century. The future holds even greater promise for further important Chase Bag developments—continuing to give you better and more economical containers for your products.

CHASE since 1847 BAGS

for Better Bags...Better Buy Chase

CHASE BAG CO. GENERAL SALES OFFICES, 309 WEST JACKSON BLVD., CHICAGO 6, ILL.

BOISE • DALLAS • TOLEDO • DENVER • DETROIT • MEMPHIS • BUFFALO • ST. LOUIS • NEW YORK • CLEVELAND • MILWAUKEE
PITTSBURGH • KANSAS CITY • LOS ANGELES • MINNEAPOLIS • GOSHEN, IND. • PHILADELPHIA • NEW ORLEANS • ORLANDO, FLA. • SALT LAKE CITY
OKLAHOMA CITY • PORTLAND, ORE. • REIDSVILLE, N. C. • HARLINGEN, TEXAS • CHAGRIN FALLS, O. • HUTCHINSON, KAN. • CROSSETT, ARK.

If your equipment requires uniform pressures to operate correctly, don't let it bother you. CASH-ACME manufactures all types of pressure control equipment from ¼" to 2" pipe sizes for water, air, oil, steam, gas and liquid service.

If one of our standard models doesn't do the job, we'll try and develop a special valve for you.

CASH-ACME Type A-16" Pressure Reducing Valve

Write for your free copy of our new 1948 Catalog, giving full details about CASH-ACME Products, or ask your mill supply dealer for—

CASH-ACME *Automatic Valves*

A.W. CASH VALVE MANUFACTURING CORPORATION

these essential foodstuffs and making them available at less cost to the consuming public.

65. Dyestuff Intermediate

OF PARTICULAR interest as an intermediate in the preparation of dyestuffs and other fluorine compounds is the new product *m*-nitrobenzotrifluoride (*m*-nitrotrifluoromethylbenzene) that is now being produced in pilot-plant quantities by the Hooker Electrochemical Co. of Niagara Falls.

A pale, straw-colored, oily liquid, *m*-nitrobenzotrifluoride possesses an aromatic odor. The CF_3 group is stable to further chemical reaction. The NO_2 group may be reduced. The product is also subject to further nuclear substitution. A typical ASTM distillation range is 200.5 to 208.5 deg. C.; freezing point is −5.0 deg. C.; specific gravity is 1.437 at 15.5 deg. C.

WE VISIT THE CHEM SHOW

(*Continued from page 151*)

shown by the St. Regis Paper Co., New York. These units are made from linen, canvas or paper impregnated with a thermosetting resin, the resin and filler being varied to achieve the desired chemical resistance.

The Selas Corp. of America, Philadelphia, showed an improved model of its Liqui-jector, a phase separator for continuously and automatically removing water from compressed air lines. The device uses surface tension to effect separation and also acts as a filter. It is now produced in sizes up to 75 cfm. for water discharge rates up to 2.5 gal. per 24 hr.

Two new miniature pressure filters, one of 1,000 cc. capacity, operated on compressed air, and the other of 350 cc. capacity, operated by a pressure bulb, were shown by the Sparkler Mfg. Co., Mundelein, Ill. These units have a single filter leaf in the bottom and the larger can be provided, if desired, with a plastic internal construction so that no metal is in contact with the liquid handled.

Two new cylindrical pressure type filters were introduced by the Titeflex Co., Newark, N. J. A new Dutch weave stainless steel filter element is employed. Filter and precoat tanks are rubber lined, but interconnecting piping can be either Saran or Haveg. The company also showed two smaller laboratory or pilot units of stainless steel with capacities of 276 and 420 gph.

Magnetic Separation—Indicative of the recent trend toward the use of permanent magnet separators was a

For over 25 years, processing men have relied on the consistent high standard of Alsop "Hy-Speed" Mixers and Agitators —and on the technical service of the Alsop Engineering Corporation to help solve their mixing problems.

Whether your problem is mixing, blending, suspending or dissolving, you can handle it simply and economically with an Alsop "Hy-Speed" Mixer or Agitator.

Perhaps we can help you solve your mixing problem; write giving details of liquids and quantities to be handled.

This portable "Hy-Speed" Mixer, equipped with our easy-to-mount, quickly adjustable clamp, makes any tank a mixing tank. Available in a wide range of horse-powers, propeller combinations and speeds.

ALSOP
ENGINEERING CORPORATION
Filters · Filter Discs & Sheets · Mixers · Agitators
310 White Road, Milldale, Connecticut

ELECTRUNITE

Stainless Steel Tubing

DATA and STOCKS...

Representatives located in: Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee • New York • Philadelphia • Richmond • St. Louis • Salt Lake City • San Francisco and Seattle.
Distributors located in: Boston • Buffalo • Chicago • Cincinnati • Cleveland • Columbus • Hartford • Houston • Kenosha, Wis. • Kansas City • Kingsport, Tenn. • Los Angeles • Oakland • Philadelphia • Pittsburgh • Portland • St. Louis • San Francisco • Seattle • Shreveport • Sumter, S. C. • Toledo and Union, N. J.

WHEN AND WHERE YOU NEED THEM!

● Right in your own city—or in one nearby—there's a Steel and Tubes representative ready to give you helpful technical information on stainless steel tubing.

He's the man who can tell you the complete story about ELECTRUNITE Tubing made of Republic ENDURO* Stainless Steel; *why it's always uniform in diameter, wall thickness, concentricity, strength, ductility and workability.* He can advise you, too, on the selection of the proper stainless steel analysis to best meet specific application requirements.

And in the same city—or not far away—is your ELECTRUNITE Distributor who can supply you with ELECTRUNITE Stainless Steel Tubing from warehouse or on mill delivery *in both pipe and tubing sizes.* You'll find him always ready to help you in any way possible.

Get in touch with your Steel and Tubes sales representative and your ELECTRUNITE Distributor. They're good men to know. If you would like their names and addresses, write us.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Dept.: Chrysler Bldg., New York 17, N.Y.

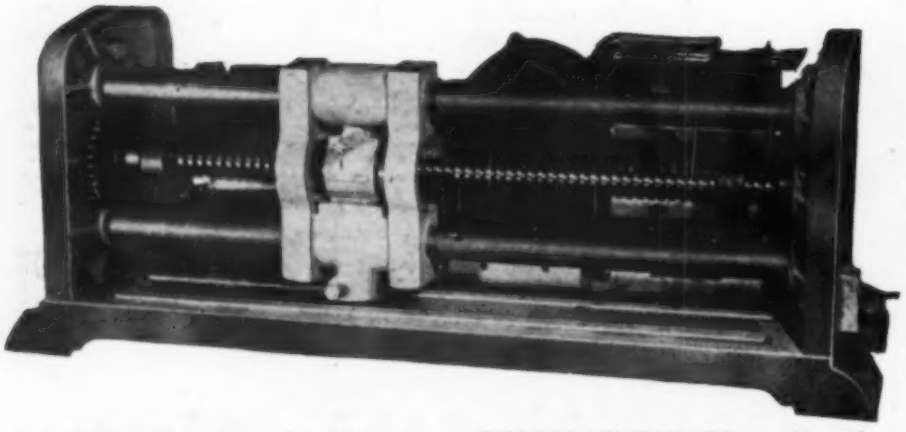
*Reg. U. S. Pat. Off.

REPUBLIC STEEL

Republic
ELECTRUNITE
STAINLESS STEEL TUBING

Does your product need policing?

GEARY-JENNINGS Produces *and* Safeguards Accurate SAMPLING



It's all automatic and under absolute control . . . both the process for true sampling and the safeguard against tampering and intrusion of dust and dirt.

This famed machine—in use in metallurgy and chemical process industries throughout the world—is ruggedly built, self-contained and constant in performance.

GEARY-JENNINGS applies the true sampling principle to wet or dry materials and is readily adaptable to existing or new conveyor systems. It is easy to install and requires little head room.

New literature, fully illustrating and describing Geary-Jennings Samplers on request. Special inquiries are answered promptly and in full detail.

"Leaders in Experience & Service"

THE GALIGHER CO.

Home Offices
545 West 8th South St.
Salt Lake City 4, Utah

Eastern Offices
921 Bergen Ave.
Jersey City 6, N. J.

cross-belt type shown by Dings Magnetic Separator Co., Milwaukee, Wis. The unit consists of a belt conveyor with a cross-belt and magnet suspended above it for the removal of tramp iron at right angles to the conveying belt.

Several other magnetic separators of the permanent type were shown by Eriez Mfg. Co., Erie, Pa. Among these was a new pipeline trap of corrosion resisting construction for 2-, 3- and 4-in. pipeline sizes. This concern showed its new Puri-Pulley separator pulley featuring a concentrated field for removing fine iron or less magnetic particles automatically. It also demonstrated its permanent magnet drum for removing coarser iron contamination.

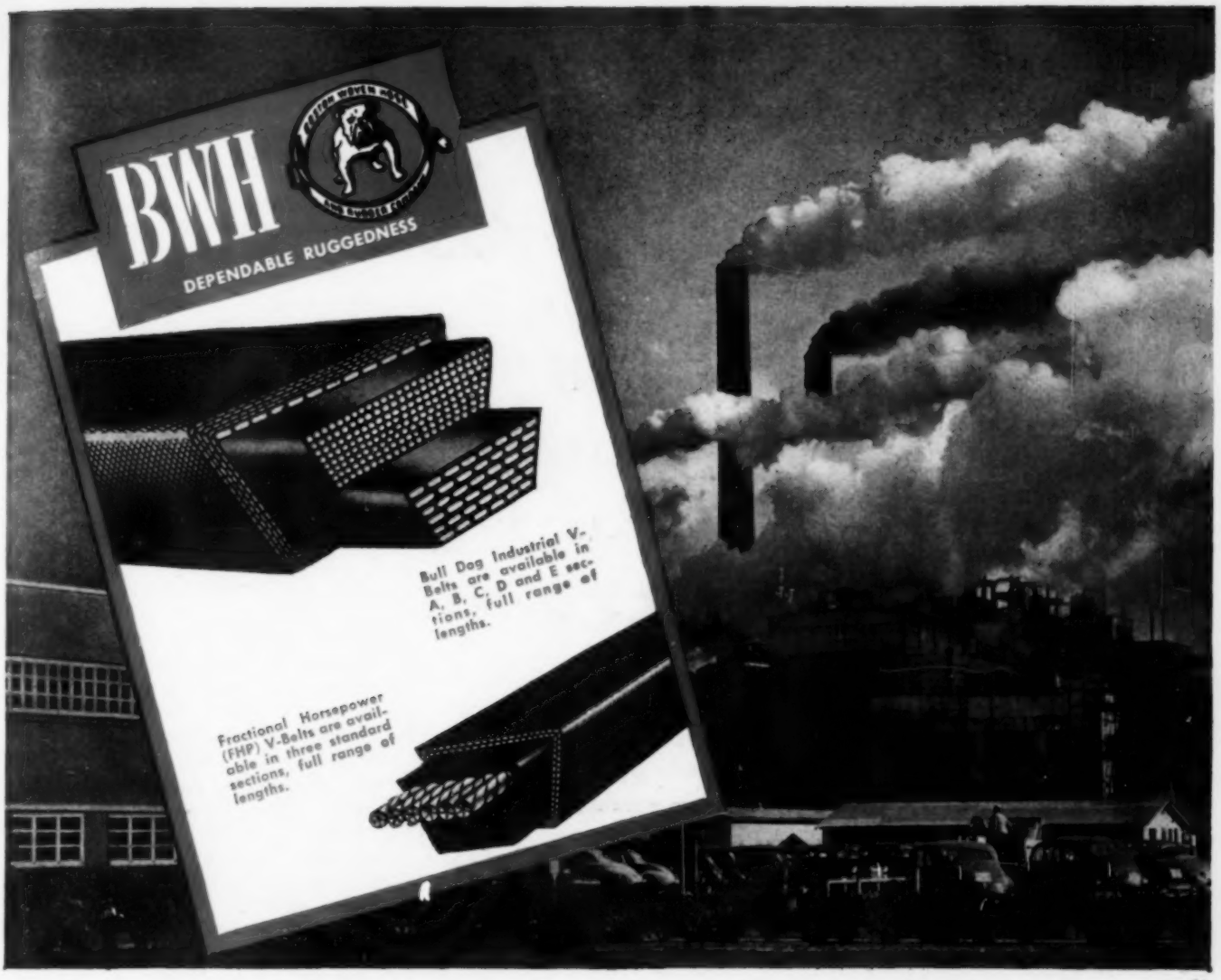
Safety Equipment

Dunn Products, Chicago, showed a new rubber acid pail in capacities of 6 and 12 qt. for handling corrosive materials at temperatures up to 212 deg. F. The pail is flexible and has a stainless steel handle. The same concern exhibited new plastic-coated safety gloves of superior anti-slip qualities, primarily for use in oil industries. Mine Safety Appliances Co., Pittsburgh, showed its new Pneophore, an automatic oxygen administration apparatus for artificial respiration. Standard Safety Equipment Co., Chicago, exhibited new anti-skid clogs of fabric-reinforced synthetic rubber, as well as new plastic hoods and suits. One of the latter gives complete protection for the entire body and provides space enough for a Scott Air-Pak respirator to be worn.

Other Equipment

Materials Handling—Its Multi-Tier unit, originally introduced in the food field, but now being offered for other purposes, was shown by the J. W. Greer Co., Cambridge, Mass. This device is a continuous handling unit for products which must spend a considerable period of time under controlled conditions of temperature, drying, or atmosphere, and yet must be processed continuously. A number of trays move continuously from a loading section, through the Multi-Tier section (where as many rows of trays as necessary are stacked up as closely as possible), to a final unloading section. An ingenious mechanism is provided to hold the trays level at all times regardless of the direction of motion.

A vibrating conveyor, known as the Hydra-Flow, was introduced by the Link-Belt Co., Chicago. This vibrating conveyor is mechanically vibrated through a simple hydraulic system in


BWH
DEPENDABLE RUGGEDNESS
Bull Dog Industrial V-Belts are available in A, B, C, D and E sections, full range of lengths.
Fractional Horsepower (FHP) V-Belts are available in three standard sections, full range of lengths.

HERE'S WHY ALL INDUSTRIES ARE TURNING TO NEW BULL DOG V-BELTS

Industrial experts agree that the most important factor in improving productivity is better equipment. As a result, they're scanning new products eagerly and giving them thorough workouts. And BULL DOG V-BELTS are among the newcomers that have more than won their spurs in every trial.

It's typical of the 70-year BWH fame for precision that these V-Belts weren't put on the market till they'd been exhaustively tested in the field. BULL DOGS proved they had real tenacity. They gripped tighter, slipped less, stayed on the job longer. And here's the construction that accounts for this superior performance:

1. Exclusive Bull Dog Cord Section has higher tensile strength—able to carry the load and absorb shock.
2. Low Stretch, because exclusive Bull Dog Cords are processed in a new way. As a result there's less slippage, fewer adjustments, longer life.
3. Cool Running—thanks to quality-controlled compounds developed in BWH laboratories, which don't crack or deteriorate under severe flexing.
4. Wear-Resistant covers—made of bias-cut heavy fabric to protect heart of belt from dirt, grease, moisture.

Specify Bull Dog V-Belts on all replacements. You'll find they mean "More Power To You" every time.

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems . . . we're specialists in solving them. Consult your nearest BWH distributor or write to us direct.

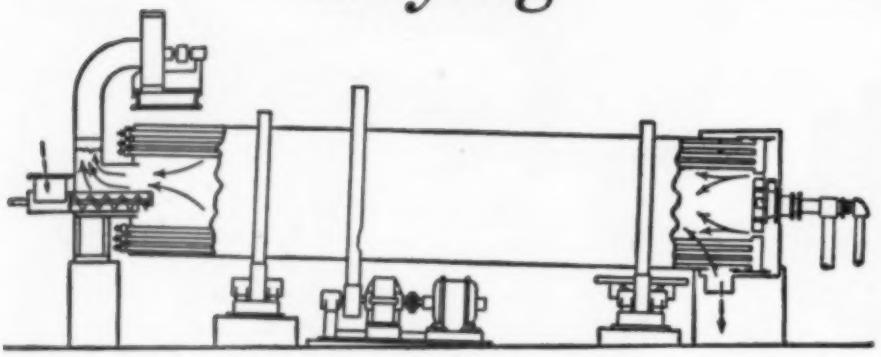
Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.

For EFFICIENT *Low-Temperature Drying*



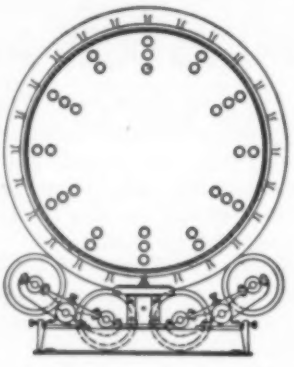
RUGGLES-COLES "XC" *Rotary Dryers*

The Class "XC" Ruggles-Coles Dryer, made by Hardinge, is a highly-efficient, indirect-heat, low-temperature steam dryer.

It is especially adaptable for drying materials that are injured by high-temperature—such as brewers' grain, cotton seed, starch feed, tobacco stems, corn germs, cannery wastes, and food products.

Basically, it is a rotary, cylindrical type dryer with steam pipes on the inside of the shell that rotate with it, and also serve as lifting flights.

For full details on this and the eight other types of Ruggles-Coles Dryers, write for Bulletin 16-C.



Cross Section of Class "XC" Dryer

HARDINGE

COMPANY INCORPORATED

YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1

which a rotating eccentric moves a piston through hydraulic pressure, the amount of movement depending on the quantity of oil displaced, which can be varied to suit the desired stroke. Trough widths can be supplied from 12 to 18 in.

Power Transmission — Link-Belt Co., Chicago, also showed its new Electrofluid drive which involves placing a hydraulic coupling between the motor and the power drive shaft. The unit is designed for applications where high starting loads are found and is available in sizes from ¾ to 20 hp.

Rockwell Mfg. Co., Hydraulics Division, Pittsburgh, showed its new rotary power pump known as the Rotocycle, as well as a new variable speed agitator drive based on this pump. The pump is a fixed-volume, double-acting rotary type available in sizes from 25 to 230 gpm. at 300 psi. One of these pumps, driven by an electric motor, can be connected hydraulically to a second pump driving an agitator. Variable speed is attained by use of an automatic governor on a bypass. A single pump can also drive a multiplicity of agitator drive pumps.

Presses—A number of improvements in tablet and preform presses were exhibited by Arthur Colton Co., Detroit. This company's entire line has been redesigned for improved appearance, and the use of all-welded steel rather than castings. Models exhibited included a preform press with a cavity 3½ in. in diameter and a 3 in. fill, as well as tablet presses for ⅝ in., 1 in. and 1¼ in. tablets. Depending on tablet size, some of these units can produce as high as 4,500 tablets per minute.

Other new tableting and preform presses were shown by the Defiance Machine Works, Toledo. One model having a two-step plunger action, said to give more homogeneous preforms on finely powdered material can, with multiple dies, turn out 10,000 tablets of ⅛ in. diameter per minute.

Pulverizers—A greater capacity than was available with previous models is claimed for a new pulverizer shown by the W. J. Fitzpatrick Co., Chicago. This pulverizer features automatic feed, with a variable speed screw, greater grinding area, and a water jacketed grinding chamber as in previous machines of this manufacturer.

Pulverizing Machinery Co., Summit, N. J., exhibited a new laboratory grinding mill known as the Mikro-Samplmill, as well as an improved version of its screenless No. 2 SP Micro-Pulverizer for moist, plastic and waxy materials. The novel feature of this machine is a rotating drum feeder beneath the impact unit, which carries material to be pulverized into the rotating knives.

BLAW-KNOX provides...

QUICK-OPENING CLOSURES

FOR HIGH PRESSURE AUTOCLAVES

Easy access to the interior of high pressure autoclaves and special pressure vessels, is made possible by Blaw-Knox Quick-Opening Closures.

These are especially desirable for cleaning and for inspection or changing of agitators, coils or other internal devices.

Blaw-Knox specializes in the design and construction of high pressure autoclaves of all sizes and types, and for all purposes. Autoclave units incorporating the quick-opening closures as illustrated can be furnished in standard sizes. When you are in need of an Autoclave—consult Blaw-Knox.

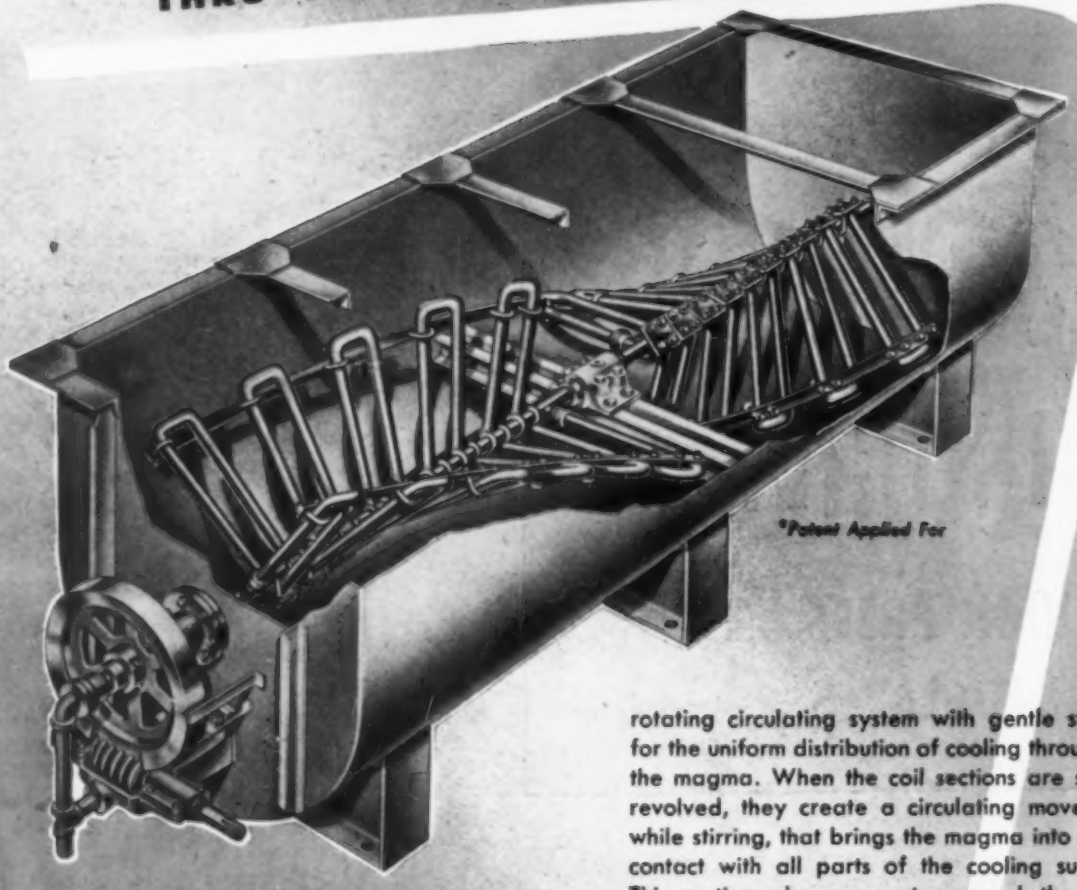
BLAW-KNOX DIVISION
of Blaw-Knox Company
2090 Farmers Bank Bldg., Pittsburgh 22, Pa.
New York • Chicago • Philadelphia • Birmingham • Washington

Send for Bulletin No. 2081 on Blaw-Knox Autoclaves.

BLAW-KNOX *IMPLEMENTS THE* PROCESS INDUSTRIES

FASTER, UNIFORM CRYSTALLIZATION

THRU MORE EFFICIENT HEAT TRANSFER



*Patent Applied For

In the crystallization of saturated solutions containing sugar, organic or inorganic salts, or similar material, efficiency of stirring and of heat transfer determines quality and yield of product.

To overcome the deficiencies of conventional-type crystallizers, where heat exchange takes place only through the surrounding wall of the vessel, the Acme Crystallizer,* employs two oppositely directed helical coil sections within the shell. Mounted on opposite sides of a center bearing, these coil sections provide a rotating circulating system with gentle stirring for the uniform distribution of cooling throughout the magma. When the coil sections are slowly revolved, they create a circulating movement, while stirring, that brings the magma into direct contact with all parts of the cooling surface. This motion also serves to spread the seed crystals rapidly throughout the mass, thus hastening the process. As a result, false grain is avoided and crystals of more even texture will be consistently obtained.

After crystallization is completed—to prepare the magma for more efficient centrifugal separation—a warm fluid may be circulated through the same helical coil sections. The uniform, rapid heating thus achieved will facilitate subsequent centrifugal separation.

For additional details, consult Acme engineers, without obligation.

CLARIFIERS • EVAPORATORS
VACUUM PANS • CONDENSERS
HEAT EXCHANGERS • DRYERS

ACME
Processing Equipment
ACME COPPERSMITHING & MACHINE CO., OAKLAND, PA.

Lewis, Bradley, Wagner—Big Three In . . .

Chemical Unions

Here is an authoritative picture of the unions of major importance in the chemical industry, who runs them, and their policies on the Communist situation.

By Joseph M. Gambatese

Washington Labor Editor, McGraw-Hill Publishing Co.

ABOUT 16,000,000 workers—more than one in four—carry union cards in the United States.

They are members of more than 60,000 local unions affiliated with 200 national and international labor organizations.

More than 2,000,000 of them went on strike last year against 3,700 employers, losing 34,600,000 man-days of production or service.

Hourly wages during the past seven years have doubled.

Do these statistics startle you? They shouldn't. Their magnitude simply exemplifies the extent to which labor unions have grown and intensified their influence on business during the past decade; something that management has been watching with increasing concern.

Today the operation of a successful business requires more than technical knowledge and business acumen. In many cases it requires successful relations with unions representing your employees, because encouragement of collective bargaining through labor unions has been a government policy since 1935. Perhaps we should include this as part of "business acumen." Anyhow, more than one business has failed or prospered, depending on the soundness of the management's relations with a union and its leaders. In Europe, governments have fallen.

A good chemist knows the potentials of the chemicals he mixes. An astute business manager should know the needs, the aspirations, the objectives of his employees, and their union, where there is one. How will they react under certain circumstances?

Part of the answer comes from knowing the unions your employees join, having some knowledge of the union leadership, union policies, union strategy.

The broad objectives of most unions are the same: Higher real wages, better working conditions, more security, stronger union. We won't go into these. They are well known. Instead, we will examine the other points.

Today the two most controversial policy questions confronting unions (and some employers, too) are use of the Taft-Hartley labor law and dealing with Communism in unions. They are somewhat related because of the T-H law rule that unions may not utilize the protective features of the National Labor Relations Board unless their officers sign affidavits disavowing Communism.

In these columns last month we discussed the impact this affidavit requirement has had on labor-management relations; how it changed bargaining rules and strategy.

What the effect will be in your plant will depend largely on the union you bargain with and/or the union knocking on your door, if there is one there trying to organize your plant or replace another union.

Just what is the Communist situation in the unions most active in the chemical industry?

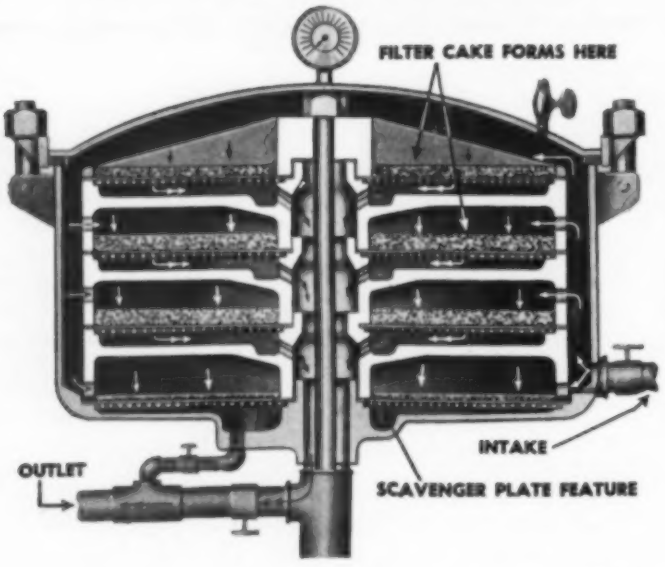
It's not very serious, especially when one considers the problem in electrical manufacturing, maritime, communications, fur, metal mining and other industries.

Big Five

There are five unions with substantial membership among chemical workers. Three are affiliated with the CIO—the Gas, Coke and Chemical Workers, the Rubber, Cork, Linoleum and Plastic Workers, and the Oil Workers. Another is the AFL Chemical Workers. The fifth is that catch-all District 50 of the United Mine Workers, which has been in and out of the CIO and AFL and, currently, is as independent as its truculent president, John L. Lewis.

Only one of the five has had a major Communist problem. It is the Gas, Coke and Chemical Workers, which we call the CIO Chemical Workers. This union had its beginning in 1942

SPARKLER
horizontal plate
FILTERS



. . . are efficient and reliable in the process of solvent recovery

In Sparkler Horizontal Plate Filters the filter cake rests flat on the supporting metal plate without tensile or distortive strain. In this position the cake will not crack under pressure and complete dependable filtration is assured.

Practically every kind of liquid from light alcohols to heavy rosins can be filtered in a Sparkler Filter. Filters can be designed and constructed for any particular type of fluid to be filtered. Steam jacketed models where required and brine jacketed models when cooling is necessary. Tanks and working parts are made in a range of materials including stainless steel, mild steel, bronze, nickel, monel, or rubber lined steel. Explosion proof motor equipment used when required. Filter plates are available in two depths, deep plates for liquids carrying a large percentage of solids; shallow plates for liquids carrying only a small percentage of solids, the latter providing a larger filtering area within the same size tank.

Sparkler Filters are equally efficient for continuous or intermittent operation. Complete recovery of product is obtained by "wash through" or "blowdown" of cake without removal from filter. The Sparkler patented scavenger plate acts as an auxiliary filter with independent control valve, filtering each batch down to the "last drop", leaving no hold-over.

Sparkler Horizontal Plate Filters are made in a range of sizes from the small laboratory pilot plant models to the standard plate models of 50 G.P.H. to 5000 G.P.H.

Our engineers are ready to cooperate in solving any problem of filtration. Write R. S. Lipp, Industrial Sales Dep't.

In the recovery of naphtha and benzol solvents at the Bayer Aspirin plant Sparkler Horizontal Plate Filters are installed in the processing line.

SPARKLER horizontal plate FILTERS

SPARKLER MANUFACTURING COMPANY, Mundelein, Illinois

when Lewis pulled out of the CIO. It was formed from locals of District 50 wanting to stay in the CIO. Because Lewis is isolationist and the Communist Party line then called for war on the side of Russia, all the Communist-tinged locals stuck with the CIO.

Martin Wagner, former St. Louis utility employee and head of District 50, took the side of CIO President Philip Murray in the split with Lewis. He led the new CIO union and remains its president today.

Until last year, Wagner and the Communist element in the union cooperated. Wagner had to build the union up, and Communists are eager organizers. At the union's convention two years ago, a breach developed. A compromise unity program was adopted to pacify both sides. But last year Wagner cracked down on the Communists, pushing an anti-Communist policy statement through his executive board. Later, two vice presidents and an executive board member who refused to conform, were relieved of duty. This year's convention banned Communists or Fascists from holding union office and refused to re-elect the three, one of whom faces deportation as an alien Communist.

Oak Ridge Loyalty Tests

All officers of the CIO Chemical Workers now are ardent anti-Communists. At Oak Ridge, where the union has a contract at Carbide & Carbon Chemicals Corp.'s K-25 gaseous diffusion plant, the local union members and officers have all passed loyalty checks by the FBI. None of the other unions has a contract covering atomic workers.

Even so, the CIO Chemical Workers has not gone as far as the others against Communists. The other unions won't even admit proved Communists or Fascists as members, according to their constitution. And District 50 won't take in members of Chambers of Commerce, either.

Of course, there are Communists in these unions, despite any technical ban. But they have little, if any, influence.

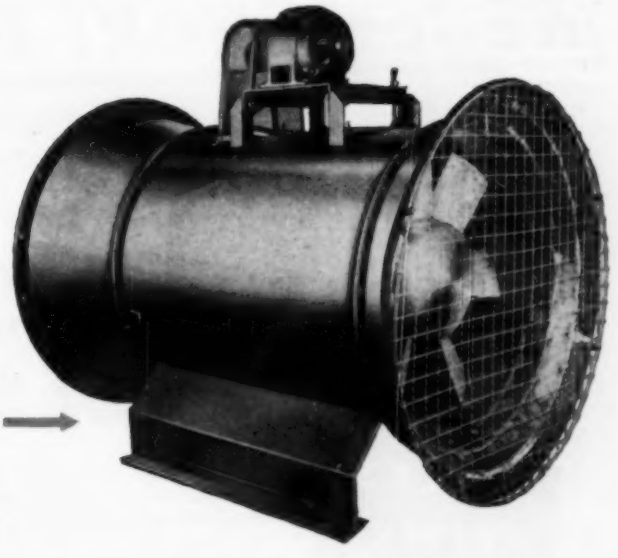
There's a sizable group of Communists in the rubber workers which joined with other opponents of the right-wing president, L. S. Buckmaster, and almost helped prevent his re-election at the Omaha convention in September. The vote couldn't have been any closer, 810-808. Buckmaster's opponents, however, won 8 of the 12 seats on the executive board. Yet, they refused to follow the Communist Party line and voted to endorse President Truman's re-election and back the European Recovery Program. This

This Fan Selection GIVES YOU PEAK PERFORMANCE

"Buffalo"

LIMIT-LOAD FANS

For best results in your air handling problem, you need *more* than a well-engineered, well-constructed fan. It's just as important to have a fan *designed for that job!* That's why "Buffalo" builds so many types. For example, the "Buffalo" Limit-Load Fan is ideal for high-volume, low-pressure ventilation—especially where bad duct connections (elbows near inlet, etc.) are encountered. Directional inlet vanes, perfectly balanced rotors and improved housing scroll design make for exceptional air delivery at low costs in these sturdy fans. *"Buffalo" representatives in principal cities can give you unbiased advice on the fan to serve you best!*



"Buffalo"

AXIAL FLOW FANS

Both types are popular, proven and efficient. Certain conditions, however, definitely call for Axial Flows. These are ideal for *straight* duct connections—since they derive their quiet, turbulence-free air delivery from their "beeline" design. As a "booster" for an existing system—or a single unit for low-cost ventilation of mine, ship or factory—in food cooling—industrial exhausting—diesel cooling—many other installations, duct-connected or not—it will pay you to check into "Buffalo" Axial Flow Fans. *Write us about your air problem!*

A "Must" FOR EVERY ENGINEER!

FAN ENGINEERING 5th Edition offers you 808 pages of latest facts on air problems, including: fans, air flow, sound laws, heat, cooling, drying, properties, humidity, air conditioning!

ORDER YOUR COPY NOW! Price $6.00 Postpaid in U. S. A.

BUFFALO FORGE COMPANY

501 Broadway Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

"Buffalo" FANS for EVERY APPLICATION

NICKEL CALANDRIA

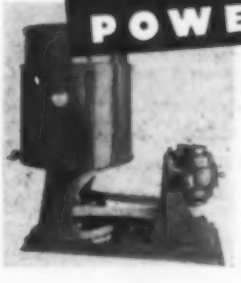
LEADER BUILDS
TANKS — KETTLES — FRACTIONATING COLUMNS
HEAT EXCHANGERS and SPECIAL EQUIPMENT
OF
STEEL—STAINLESS STEEL—NICKEL—MONEL
INCONEL — COPPER — EVERDUR — HERCULOY
HASTELLOY — ALUMINUM and CLAD STEELS

LEADER IRON WORKS, INC.
2200 N. JASPER DECATUR, ILLINOIS

ABBÉ-LENART MIXER

Completely
DISPERSES
GRINDS
EMULSIFIES
IN 1 OPERATION

SAVES
TIME
LABOR
POWER



Whether dissolving or dispersing solids in liquids, mixing two or more liquids together, or making creams, emulsions or pastes, this high speed machine gives a more homogeneous product two to five times faster than can be done with any other mixer.

This is not just a claim. It's cold fact. In one plant, the "Lenart" makes pastes and creams in one-half the time with 40% less labor than was required in paddle mixers. In another plant, emulsions are made in the "Lenart" without need for heating the base, mixing the materials and then passing them through an ointment mill, thus cutting down handling, space, extra equipment and labor.

Get the whole story—Bulletin 62 on request.

ABBE ENGINEERING CO.
46 Church St., New York 7, N. Y.

provoked considerable consternation in the columns of the Daily Worker.

Of the five unions we are looking at, only District 50 has refused to file non-Communist affidavits. John L. Lewis decided against it "on principle" because, he says, he does not want in any way to use the Taft-Hartley law. He points out, quite accurately, that the affidavits are not mandatory, but are asked only of those unions wanting to use the NLRB. The mine workers feel they do not need NLRB help, so District 50 must get along without it, too.

This raises some difficulties. District 50 cannot be certified as a bargaining agent. It cannot defend itself on the ballot against a rival union seeking to replace it. It cannot get a union shop. It cannot file unfair labor practice charges with NLRB.

Recognition Strikes

Under these circumstances, an employer having relations with District 50 may run into trouble, because District 50 makes a good target for raiding by rivals. We told you last month about Du Pont's experience at Belle, W. Va. District 50 had a contract. The CIO Chemical Workers got an election, but District 50 could not get on the ballot, so it campaigned for a "no union" vote. "No union" got a bare majority, then District 50 struck for continued recognition. It was a bad strike. The plant is now operating, but with no union contract. Another election can be held in a year. If District 50 still can't get on the ballot, there may be more trouble.

When your plant is being organized for the first time, chances that the union will strike for recognition are greater when the union is District 50. That is because it cannot resort to the peaceful election machinery of NLRB, as the others can.

And because District 50 cannot sign a union shop, which requires all employees to join the union and keep their dues paid, employers will face more pressure for a dues checkoff from this union. Unions in this predicament are insisting on the checkoff as a substitute for the security of a union shop.

Most employers dealing with unions fear a strike more than anything else. They should. It is the strongest weapon a union carries. A bad strike can ruin a business. On strike policy, all five unions we are discussing require in their constitutions that a strike must be approved by the national officers as well as the local union and the members affected.

The Oil Workers require a three-fourths majority vote of the local union members; the AFL Chemical Workers a two-thirds majority. The oil and

ARMSTRONG STEAM TRAPS

Are Guaranteed

1. Free from defective materials or workmanship;
2. To function perfectly;
3. To fulfill all claims in every respect;
4. To give COMPLETE SATISFACTION.

ONLY A GOOD STEAM TRAP COULD POSSIBLY BE BACKED BY SUCH A GUARANTEE!

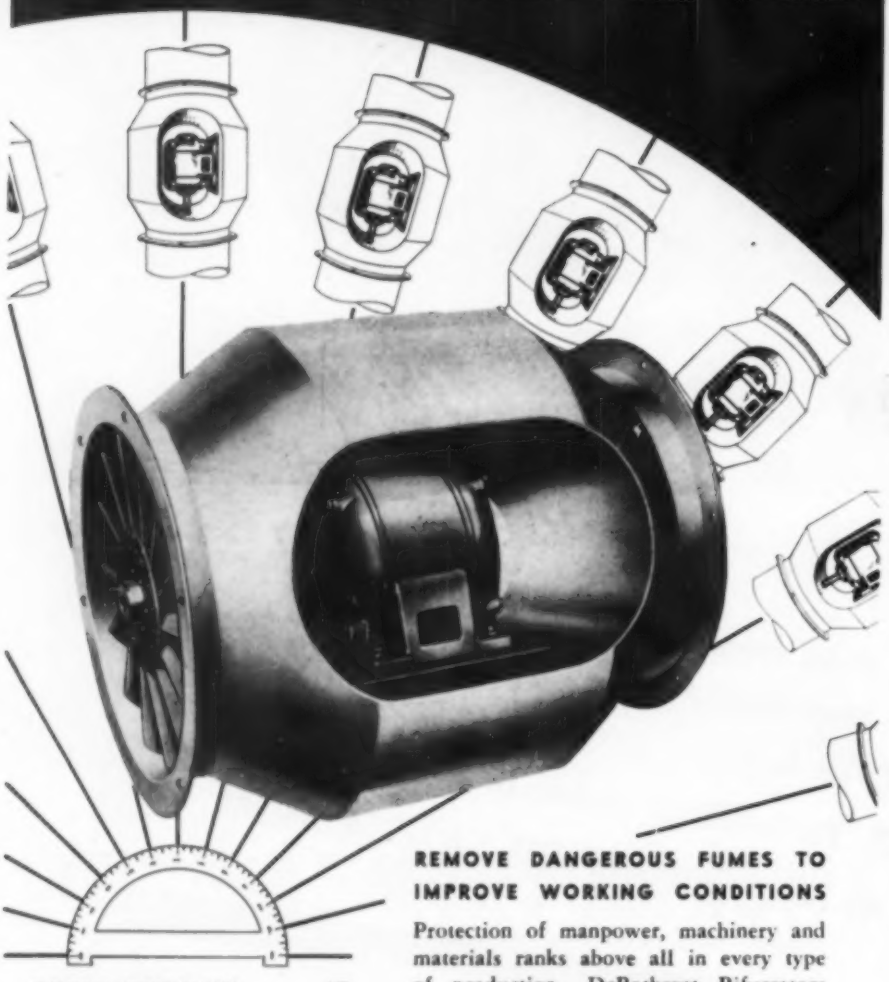
Send for the 36-page Armstrong Steam Trap Book containing complete information on trap selection, installation and maintenance practice.

ARMSTRONG MACHINE WORKS

858 Maple Street, Three Rivers, Michigan

CONSIDER SAFETY FIRST . . . INSTALL

DEBOTHEZAT BIFURCATOR FANS



EASILY INSTALLED . . . AT ANY ANGLE RIGHT IN THE DUCT

DeBothezat Bifurcators install directly in the duct without changing size or direction of the air flow. They operate with equal efficiency in any position — vertical through horizontal. No elbow bends or supporting platforms needed. Non-overloading power characteristic protects against motor failure.

REMOVE DANGEROUS FUMES TO IMPROVE WORKING CONDITIONS

Protection of manpower, machinery and materials ranks above all in every type of production. DeBothezat Bifurcators provide maximum protection by exhausting dangerous fumes from work areas. Fumes are bifurcated (by-passed) around bifurcator motor, which is open to atmosphere but isolated from destructive gasses. Safer, cleaner work areas invite greater all-around efficiency and reduce maintenance costs. DeBothezat Bifurcators available in a wide range of sizes and air capacities. Fan wheels and housings can be furnished of non-corrosive or heat-resisting materials.

WRITE FOR FREE CATALOG

For Bifurcator selection and operation details, send for brand new DeBothezat Bifurcator catalog. Dimensions, capacities and illustrated examples. Easily understandable, attractive, comprehensive.

MAIL TODAY

DEBOTHEZAT FANS DIVISION, DEPT. C,
AMERICAN MACHINE AND METALS, INC.,
EAST MOLINE, ILLINOIS

Please rush, without obligation, new DeBothezat Bifurcator catalog.

Firm Name _____

Address _____

City _____ Zone _____ State _____

rubber workers specify a secret strike ballot.

The Taft-Hartley law has brought greater emphasis on top leadership approval of strikes because of the damage suits which are permitted against unions for strikes in violation of contract. National officers want to be sure of the union's ground before risking their treasury in a contract-breaking strike.

National Officer Control

Degree of control exercised by the national officers on contract issues is also important to management. The employer is at a disadvantage if the local union does not have authority to decide the terms of an agreement.

District 50 requires that all contracts by its affiliated locals must be made in the name of District 50. Also, they must be approved and signed by the regional director and by the chairman of District 50, who happens to be A. D. (Denny) Lewis, younger brother of John L. The agreements are filed in District 50 headquarters in Washington.

In the other unions, the contracts are made with the locals, which have more local autonomy. They make and sign their own contracts. Locals of the CIO Chemical Workers in particular jealously guard this freedom, which they did not have when a part of District 50. They insist on the right to make their own contracts without interference or dictation from the national office.

Some employers prefer that the duty of making and observing contracts rest with the local union. Others find local leaders less responsible than the national. In defending District 50's policy, Denny Lewis says it puts the national office behind the contract, and often this is desirable from management's viewpoint if the national leaders will back up a no-strike clause in the event of a wildcat stoppage.

Lack of autonomy in District 50 extends to the selection of the director. He is appointed by the UMW president with approval of the international executive board. The director then appoints the regional directors. The Oil Workers elect their national officers through membership referendum after nomination at convention. The others elect their officers at convention.

District 50 is one of the 30 districts in UMW. The others are geographical districts and the locals in them represent only coal miners. District 50 was set up shortly after John Lewis started the CIO in 1935. The purpose: To organize workers in coal processing plants. Later it branched out, and now admits workers of all description in all

ALCOA ALUMINA

Catalysts and Catalyst Supports

for

aromatization

hydrogenation

hydroforming

dehydration

isomerization

dehydrogenation

hydrocarbon synthesis

hydrocarbon cracking

desulfurization

The controlled purity of ALCOA Aluminas helps promote better catalytic reactions and better end results. There is less possibility of contamination and side reactions. Difficulties arising from carbon deposits likewise are reduced.

ALCOA Aluminas—*Activated*, *Tabular* and *Calcined*—are regularly used as catalysts and catalyst supports for reactions such as those shown on the right. If you are interested in better yields from your catalytic reactions, let us send you further information on ALCOA Aluminas.

Samples for testing in your own plant will be furnished on request. Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 1778 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA

ALCOA CHEMICALS

ALUMINAS AND FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • LOW SODA ALUMINAS TABULAR ALUMINAS • HYDRATED ALUMINAS

ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE

WHEN Firth-Vickers of England signed their reciprocal agreement with Lebanon of U.S.A. for a complete exchange of ideas, information and foundry practices, it meant a lot to you.

For now you can have the advantage of the best in alloy castings which has been developed *both* in this country and in Europe.

Of great importance is the "centri-die" process of making centrifugal castings in permanent molds. Firth-Vickers developed this process to make possible the Rolls Royce, De Havilland and other jet engines. Here at Lebanon we are finding applications not only for airplane engines but also in equipment for the oil, chemical, paper and pulp, mining and other industries where corrosion and heat make service conditions severe.

When you talk to Lebanon about alloy castings you *know* you are talking to experts with a wealth of information available.

LEBANON STEEL FOUNDRY • LEBANON, PA.
"In The Lebanon Valley"

The Agreement between Firth-Vickers Stainless Steels, Ltd., Sheffield, England and the Lebanon Steel Foundry, Lebanon, Pa., U.S.A. provides for complete exchange of metallurgical and engineering data, and foundry techniques and practices. This understanding between Lebanon and the largest producer of alloy castings in Europe pools the technical knowledge and experience of both sides of the Atlantic for your benefit.

Write now for this FREE BOOKLET "Centri-die Centrifugal Castings"

Here is a clear explanation of the practical advantages to you of the Firth-Vickers Centri-die method of making alloy castings centrifugally in permanent molds. Of interest to executives and engineers who want to keep abreast of new manufacturing and production methods. Write for Bulletin E.

LEBANON ALLOY AND STEEL Castings
CIRCLE L

industries. Among them are gravediggers, bakers, needle workers, bus drivers, construction workers. District 50 recognizes no bounds to its jurisdiction. That's why it's called "catch-all".

While its activities are concentrated around the coal fields, District 50 operates 58 regional offices in 29 states extending across the country and into Canada.

The AFL first organized the chemical industry loosely, operating through "federal locals" affiliated directly with the AFL rather than through a separate national union. In 1940, to compete with District 50, the locals were banded together into a council. H. A. Bradley, a veteran AFL organizer, was elected, and still is, president. Four years ago an international AFL charter was issued, joining the locals into a full-fledged union.

The CIO Chemical Workers, an off-shoot of District 50, also has locals in gas utilities. And only parts of the rubber and oil workers unions operate in the chemical industry.

The AFL probably has the largest membership in this industry. It claims 130,000 members, mostly in chemical and allied plants. The other unions will dispute this figure as exaggerated. But then, too, their claims may also be challenged. District 50 doesn't publish any figures on membership, but Denny Lewis tells us he has 100,000 in chemicals. The CIO Chemical Workers report about 54,000 dues payers. Reported membership of the Rubber Workers is 180,000 and of the Oil Workers 75,000 but only a fraction of it is in chemicals.

Union Leaders

For the most part, the leaders of these unions are old veterans from the ranks of the workers.

Wagner, 55, worked as a mechanic in the home heating division of Laclede Gas Light Co., St. Louis.

Denny Lewis, nine years younger than his 68-year-old brother, John, worked in the mines until he was 24, then filled several government positions before going on the UMW payroll 15 years ago.

Bradley, an engineer and mechanic by trade, joined the AFL in 1913, later served 28 years as an organizer.

Buckmaster, 54, emerged from the Firestone Tire & Rubber Co., where he headed Local 7, to become national vice president of the Rubber Workers in 1941 and president four years later.

O. A. Knight, 46, president of the Oil Workers, was for many years a stillman for Shell Oil in East Chicago, Ind.

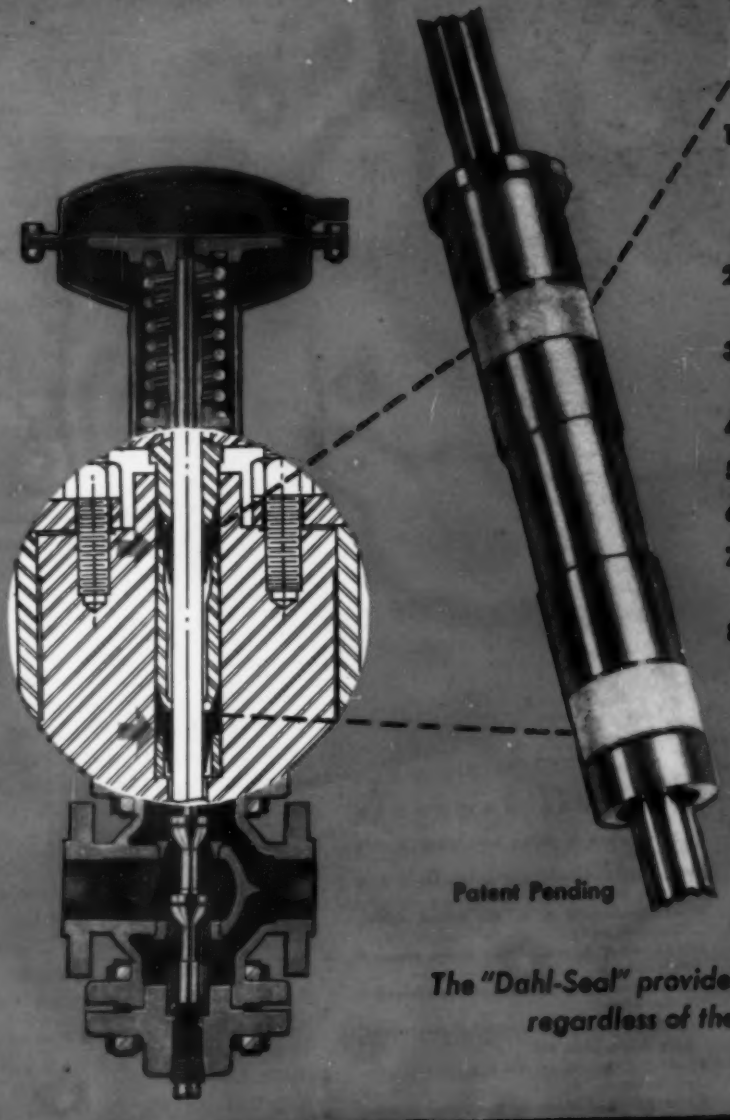
AUTOMATIC CONTROL EQUIPMENT

ENGINEERED DESIGN BY **HAMMEL-DAHL**

The "DAHL-SEAL"®

Eliminates Packing Box and its problems.

No more leakage, friction, periodic take-up, adjustment, lubrication or replacements.



Patent Pending

1. The valve stem can be positioned to an accuracy of 0.001" up to the working pressure for which the Valve Body is rated.
2. Eliminates conventional packing box leakage.
3. No periodic take-up or adjustment is necessary.
4. Seals by force of system pressure.
5. Negligible stem friction at any pressure.
6. Completely resistant to chemical attack.
7. Can be used for any temperature for which the valve is designed.
8. Available for any Hammel-Dahl Valve, including those now in service.

ANOTHER *Hammel-Dahl* FIRST

The "Dahl-Seal" provides a frictionless, leak-proof Valve stem, regardless of the static pressure in the system.

HAMMEL-DAHL COMPANY

243 RICHMOND STREET PROVIDENCE, R. I.

BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DALLAS
DETROIT HOUSTON KINGSPORT, TENN. LOS ANGELES NEW YORK OAKLAND
ODESSA PITTSBURGH ST. LOUIS SEATTLE TULSA WILMINGTON, DEL.

KEY FEATURES OF A COMPLETE STEEL SERVICE

Some types still short, but over-all stocks in 13 Ryerson plants are probably the nation's largest.

Prompt personal steel service on all orders, large or small, is a Ryerson tradition.

Accurate cutting to your order is assured by modern Ryerson equipment.

Over a Century of steel experience means more know-how applied to your steel problems.

You get quick delivery anywhere, because the network of Ryerson plants stretches from coast to coast.

PRINCIPAL PRODUCTS

BARS—carbon & alloy, hot rolled & cold finished
STRUCTURALS—channels, angles, I & H beams, etc.
PLATES—sheared & U. M., Inland 4-Way Floor Plate, etc.
SHEETS—hot & cold rolled, many types & coatings
TUBING—seamless & welded, mechanical & boiler tubes
STAINLESS—Allegheny metal sheets, plates, bars, tubes, pipe, etc.
REINFORCING—bars & accessories, wire mesh, etc.
BABBITT—and phenolic laminated bearing material
MACHINERY & TOOLS—metal working & boiler shop

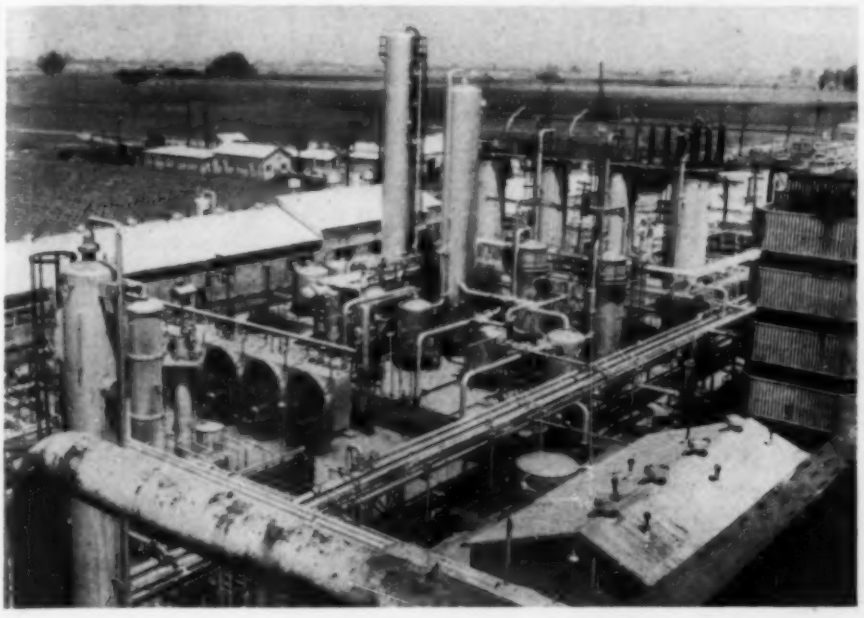
Added Ryerson service includes a chart to guide heat treating sent with alloy shipments.

RYERSON STEEL

Joseph T. Ryerson & Son, Inc. Plants: New York • Boston • Philadelphia • Detroit • Cincinnati Cleveland • Pittsburgh • Buffalo • Chicago • Milwaukee • St. Louis • Los Angeles • San Francisco

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR



Carbon dioxide is removed from natural gas by the new Union Oil unit.

Union Oil Extracts Carbon Dioxide From Natural Gas

FACILITIES for extracting carbon dioxide from natural gas have recently been completed by Union Oil Co. of Calif. in southern California's Santa Maria Valley oil field. Employing the Girbotol process, the unit lowers CO_2 content from about 15 to around 7.5 percent. Byproduct gas is used for the manufacture of dry ice. It is believed to be the first such commercial unit in operation.

Extraction follows a more or less standard Girbotol procedure. Enriched monoethanolamine-water solution, flowing cold from the base of the absorber at about 80 psig., is heated and passed downward through a stripper counter-current to hot amine and water vapors. Partially stripped solution leaves the lower part of the column to be heated in a reboiler; vapors and hot solution are returned separately. Carbon dioxide is taken off both the top and a lower tray position.

Although the Girbotol process can be used for extracting H_2S as well as CO_2, practically all CO_2 must be removed first. The small amount of H_2S absorbed and other impurities are removed in two double contact towers. In the first, an iron oxide solution is circulated through the lower half and a chromate-borax solution through the upper half. In the second, a fresh permanganate solution is circulated through the top and partially reduced permanganate through the bottom. Pure gas leaves the last column at about 23 psig., is compressed in two stages to around 500 psig., then sent through a gas dehydrator for removal of water vapor. Liquefaction takes place after compression to about 1,100 psig. and cooling to 85 deg. F. Conversion to solid is accomplished in four stages. A hydraulically-operated plunger compresses snow into cakes.

Philips Chemical Erects Ammonium Sulphate Unit

PHILLIPS Chemical Co., new subsidiary of Phillips Petroleum Co., has awarded a contract to Chemical Construction Corp. of New York City for the $6 million ammonium sulphate plant which Phillips Chemical had announced earlier would be erected at Houston, Tex. Clearing of the site has begun on the 338-acre tract purchased by Phillips from War Assets Administration. The property, formerly occupied by the Todd shipyards, is on the Houston ship channel and has been designated "Port Adams" for K. S. Adams, president of the chemical company.

Electrochemical Society Meets in New York

THE 94TH MEETING of the Electrochemical Society was held in New York in October. The program included several plant trips to companies in the metropolitan area. Among the firms visited were: Bell Telephone Laboratories and Air Reduction Co. at Murray Hill, N. J.; and Nassau Smelting & Refining Co. at Tottenville, N. Y.

Technical program included several symposiums. Dr. George W. Vinal presided at a symposium on batteries, and the discussion of electrodeposition was headed by Dr. A. G. Gray. Electrolytic production of metals was the subject of a third symposium at which Dr. R. E. Cushing presided.

President of the society, James A. Lee, presided at the general technical session.

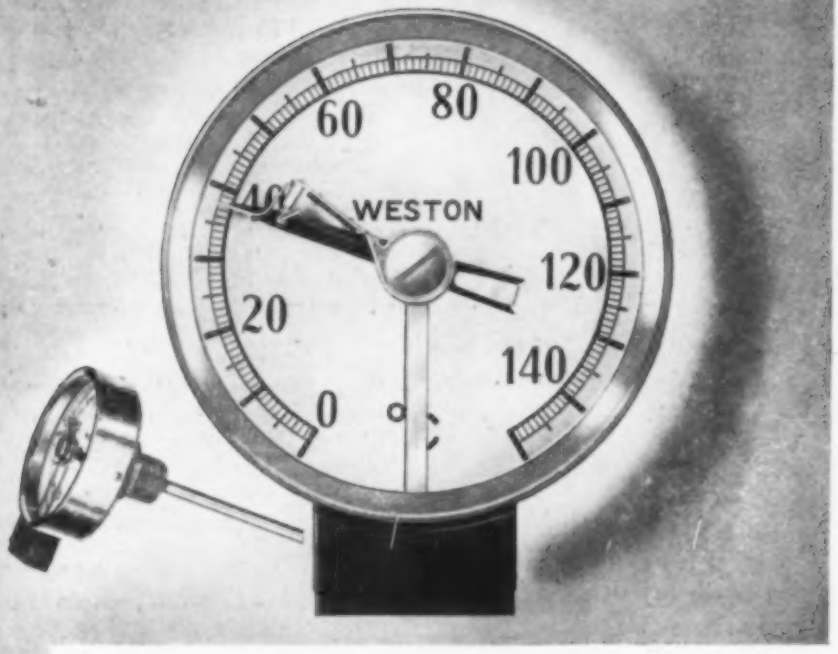
At the Acheson Medal Banquet, Dr. Duncan A. Mac Innes, was presented with the Medal in recognition of his distinguished contributions to the science of electrochemistry.

CMRA Meets in New York To Discuss Solvents

SOLVENTS was the general subject of discussion at the recent Chemical Market Research Association Meeting at the Hotel Biltmore in New York last month. At that meeting two sides of the raw materials picture for the solvent industry were presented. Charles L. Gabriel, vice-president of Publicker Industries spoke on fermentation processes, while James G. Park, vice-president of Enjay Co., discussed synthetic processes. Mr. Gabriel pointed out that in the future the price of molasses will be reasonable. He said that blackstrap molasses cannot be dumped on

NEW –

all-metal WESTON *Contact-making* thermometer



This new Weston combines the features of an indicating device with the advantages of an alarm or control instrument. A contact arm, mounted as shown above, is easily set to make contact at any temperature on the scale.

A terminal block on the periphery of the case makes electrical connection easy. The thermometer is all-metal, typically WESTON in ruggedness and reliability, with accuracy of ±1% as an indicating thermometer, and ±1½% as a contact making device. It is supplied in two types—for operation on either increasing or decreasing temperatures.

For complete information see your local WESTON representative or write Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

Industrial Thermometers | MAX-MIN Thermometers | Contact-making Thermometers

WESTON *Thermometers*

the ground by the sugar mills, and if they cannot sell it they must take it to sea for disposal. This costs money and the mills will be better off if they give the molasses away to concerns who would store it and carry it off in tankers. Mr. Gabriel summed up his paper by saying that within a reasonable time, molasses will be available at a reasonable figure, in the quantity sufficient to supply the needs of the fermenters, and that synthetic alcohol will help bring about this price stability. He said also that because of the location, the product as well as plantage and costs, present molasses alcohol plants will continue to operate competitively with synthetic for many years. He posed this question in concluding—"If you were a sugar producer would you, as a good salesman, permit your chief market for byproduct molasses and surplus cane to dry up or would you discourage the erection of new synthetic ethyl and butyl alcohol plants by promptly reducing prices to fermentation customers, so that their production costs would be at least as low as those for the synthetic producers?" Mr. Gabriel pointed out that ideas he had expressed were his personal thoughts and not necessarily Publickers'.

Mr. Park described the rapid growth of the synthetic solvent industry in the

CONVENTION CALENDAR

18th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, November 29-December 4.

Society for Experimental Stress Analysis, annual meeting, Hotel Commodore, New York, December 2-4.

Synthetic Organic Chemical Mfrs. Assn., annual meeting, Hotel Commodore, New York, December 8.

Chemical Market Research Association, winter meeting, Toronto, December 9.

Commercial Chemical Development Association, winter meeting, Chicago, Ill., January 19, 1949.

American Society of Heating and Ventilating Engineers, 9th International Heating and Ventilating Exposition, International Amphitheater, Chicago, January 24-28.

American Institute of Chemical Engineers, regional meeting, Los Angeles, Calif., March 6-9.

American Chemical Society, 115th national meeting, San Francisco, Calif., March 27-April 1.

Electrochemical Society, spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 4-7.

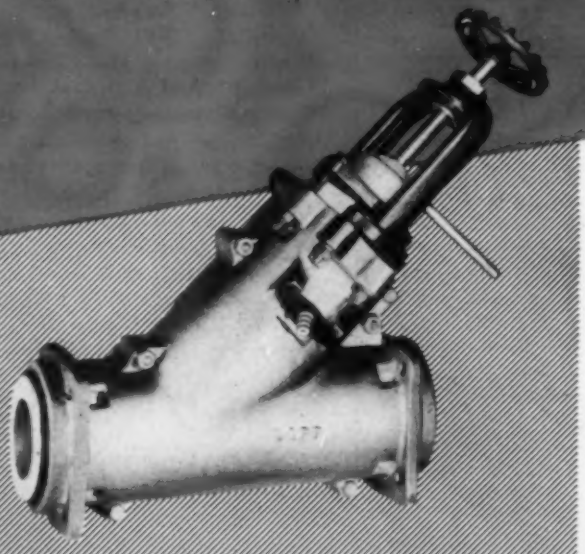
Manufacturing Chemists Association, annual meeting, Skytop, Pa., June 2.

22nd Exposition of Chemical Industries, Grand Central Palace, New York, November 28-December 3.

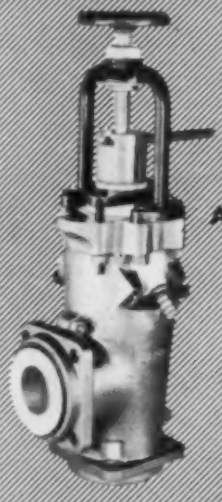
Porcelain.. Armored..

For PURITY and CORROSION RESISTANCE

For OPERATING SECURITY



Y VALVE



ANGLE VALVE

FLUSH VALVE

Lapp ARMORED PORCELAIN VALVES

● *Laboratory purity in industrial production* and *resistance to all acids except HF* are the chemical properties of processing equipment of Lapp Chemical Porcelain. Now the original Lapp Porcelain Valve is available completely encased in heat-treated acid-resisting silicon aluminum armor for protection against carelessness or accident. At a fraction of the cost of expensive alloy or lined valves, Lapp armored valves give maximum operating security as well as the purity and corrosion resistance of *solid porcelain*. Armored Y-valves in 1″, 1½″, 2″, 3″, 4″ and 6″ sizes; armored angle valves in 1″ and 2″ sizes; armored flush valves in 1½″, 2″ and 3″ sizes. Write for descriptive literature and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 335 Maple St., LeRoy, N. Y.

Lapp

PROCESS EQUIPMENT

CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS

PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

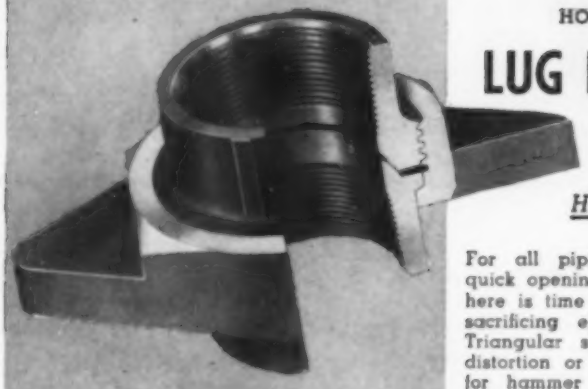
TIME AND TOOL SAVER!

HOT FORGED FROM SOLID STEEL BARS!

CATAWISSA
HOT FORGED STEEL

LUG NUT UNION

CAN BE APPLIED WITH EITHER A HAMMER OR WRENCH!



For all piping purposes requiring a quick opening and quick closing union, here is time and tool economy without sacrificing efficiency or dependability! Triangular shaped lug nut eliminates distortion or breaking (straight surface for hammer prevents glancing blow), gives you quick, easy application without thread crossing or sticking!

STANDARD WEIGHT	DOUBLE EXTRA HEAVY
to 3000-lbs. O. W. G.	to 6000-lbs. O. W. G.

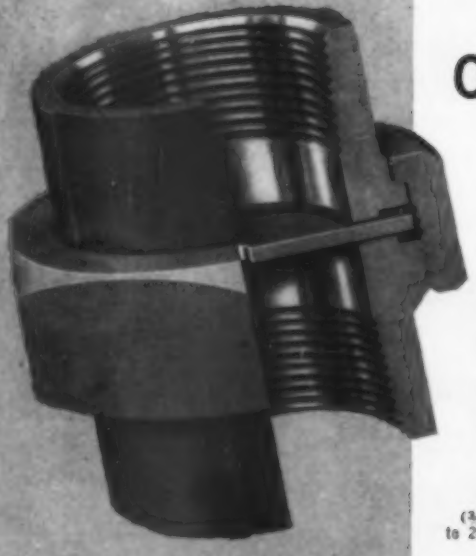
1" TO 4" SIZES WITH FULL ACME THREADS IN THE UNION NUT

for MEASURING AND METERING... for CONTROLLED FLOW

CATAWISSA
HOT FORGED STEEL

ORIFICE UNION

WITH STAINLESS STEEL OR CARBON STEEL ORIFICE PLATE!



Made with the same expert care and subjected to the same rigid inspection as Catawissa Pipe Unions, here is union dependability you can trust for measuring and metering or controlled flow of air, ammonia, chemicals, gas, oil, steam, water. Your choice of screwed ends or machined for socket welding!

STANDARD WEIGHT	DOUBLE EXTRA HEAVY
(¾" to 3" sizes) to 2000-lbs. O. W. G.	¼" to 2" sizes) to 6000-lbs. O. W. G.

WRITE FOR COMPLETE ENGINEERING DATA AND YOUR COPY OF BULLETIN 10-A

CATAWISSA VALVE & FITTINGS CO.
100 Mill St. • CATAWISSA, PA.

last two decades. He pointed out that synthetic solvent processes were developed rapidly during the past war, and that production of synthetic solvents has far outstripped the output of the fermentation industry. He pointed out that solvents such as methanol, ethanol, isopropyl alcohol and butyl alcohols can be credited with being at least partly responsible for the rapid growth of the plastics industry, the protective coating industry. He pointed out that the extent of the hydrocarbon synthesis program is still unknown and that the initial high-cost of such process plants may be partially offset by the relatively stable source of raw materials in the form of natural gas.

Richard F. Warren, assistant editor, *Chemical Engineering*, outlined growth trends of the solvent industry, pointing out that after the first World War the demand for solvents in the automobile industry accelerated its growth. From 1923 to 1948 the industry has seen a twelvefold growth, with production at the present time reaching the rate of 30 gal. per sec., or six billion pounds per year. He added that the production of methanol alone exceeds total solvent production for year 1923. He pointed out that we have reached a situation somewhat similar to that preceding the slump in the solvents market after the first World War and the corrective adjustments are due to occur again, but in a more moderate fashion. He expressed confidence in the continued growth of the solvent industry on a long-term view, and used graphs of several major solvents to portray a series of trend lines for the industry.

At the dinner session, Mr. Samuel Gibson, president of the association, introduced the dinner speaker, E. D. Paust of Esso Standard Oil Co.'s law department who spoke on the basing point decision in Cement Institute Case.

Consolidated Chemical Builds Aluminum Sulphate Plant

CONSOLIDATED Chemical Industries has started construction of a $250,000 plant for the manufacture of aluminum sulphate at Springhill, La. Completion of the plant is expected by next summer. Rated production will be about 125 tons per day.

New Science Building At Texas University

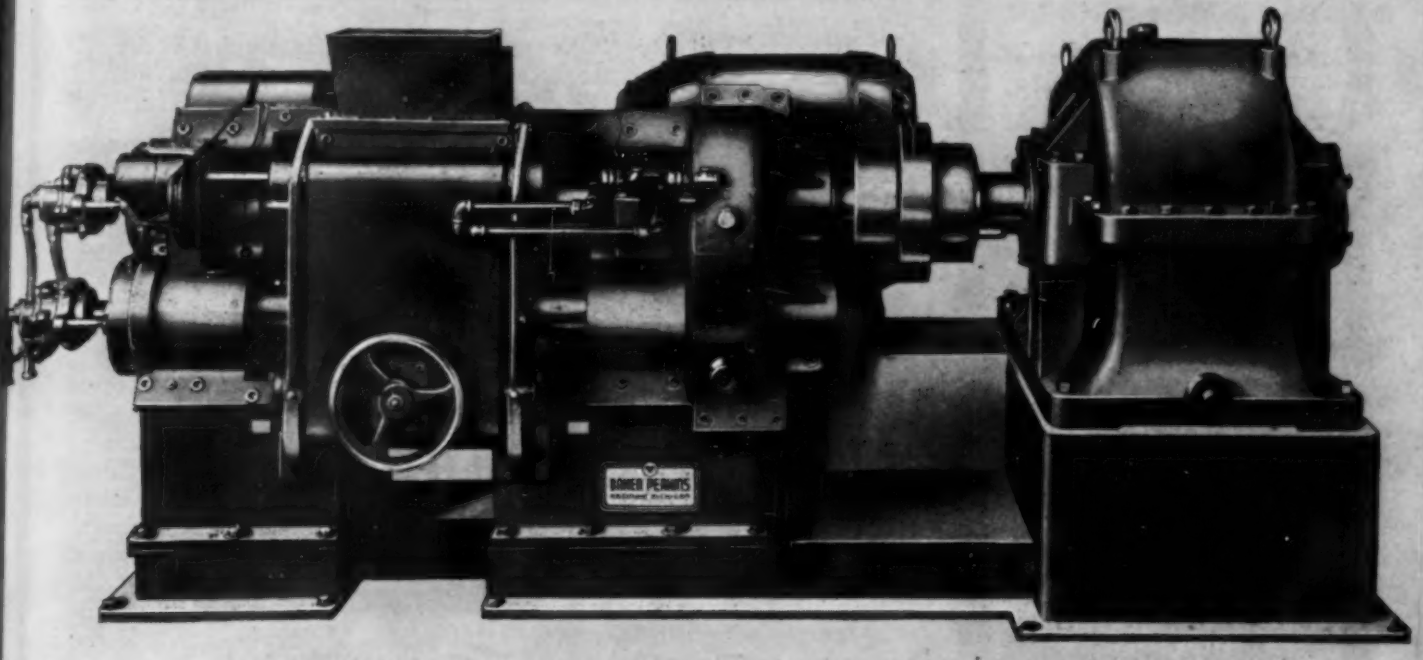
BIDS for the construction of a $4 million science building have been called for December 15 by the Uni-

FOR MORE EFFICIENT COMPOUNDING OF PLASTICS WITH PIGMENTS AND FILLERS • THE REMARKABLE NEW...

BAKER PERKINS MASTICATOR

TODAY'S MOST UP-TO-DATE PRODUCTION MIXER

Here is the newest-type masticator available on the market today. It is a typical Baker Perkins achievement, *combining experience with progressive engineering*, resulting in a mixer that does an old job better, more efficiently. Masticator blades are cored for forced feed uniform heat-



ing and cooling of blade surfaces. They are uniquely designed to *draw materials into the mixing zone*, eliminating need for ram or compression cover. Regardless of requirements, this B-P Masticator provides *positive* temperature control through the use of specially designed, jacketed mixing troughs and blades built to withstand pressures. These and many other features make the new Baker Perkins Masticator today's leading production mixer. *Get in touch with your B-P sales engineer.*

BAKER PERKINS INC. CHEMICAL MACHINERY DIV., SAGINAW, MICHIGAN

SPRAY TROUBLE? Consult MONARCH

Fig. 631

Are all of your processes using Spray Nozzles as efficient as you think they could be? Do the Sprays distribute the liquid evenly? Break it up into as fine particles as you would like? Resist the corrosion or wear conditions satisfactorily?

Send Monarch an outline of any spray problem—if your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

NOZZLES FOR:

- ACID CHAMBERS
- AIR WASHING
- CHEMICAL PROCESSING
- COOLING PONDS
- DESUPERHEATING
- GAS SCRUBBING
- HUMIDIFYING
- OIL BURNERS
- SPRAY DRYING

Do you have our Catalogs 6A and 6C?

MONARCH MFG. WORKS, INC.
2513 E. ONTARIO ST.
PHILADELPHIA 34, PA.

versity of Texas. The planned structure, 480 ft. long and 70 ft. wide, is intended to be the research center for biochemistry, biology and chemistry. The design covers a central section with five floors and a basement, and end sections with four floors and basements.

Standard Oil Development Opens New Research Center

One of the largest and most modern petroleum research laboratories in the world was opened by the Standard Oil Development Co. at Linden, N. J., last month. The new site will be known as the Esso Research Center. The first unit to be completed in the company's expansion program is the laboratory and office building.

In the opening day's ceremonies, E. V. Murphree, president of the company, described the progress made by petroleum research over the past thirty years. Guests, included some 400 lead-

FLOATLESS MAINTENANCE-FREE LEVEL CONTROL

OPERATION
Two probe rods reach into the tank to the levels where pump-on and pump-off operations are required. Actual contact of the probes with the liquid operates Photoswitch Control which makes and breaks the pump-control circuit.

UNLIMITED LIFE
No Moving Parts to Wear Out.

SAFETY
Low Voltage in the Probe Circuit.

MAINTENANCE-FREE
No Vacuum Tubes.

SIMPLICITY
No Floats, Seals, or Moving Elements.

PHOTOSWITCH Level Controls, effective for all conductive liquids, are available for single-level indication or control, on and off pump control, and boiler feedwater control.

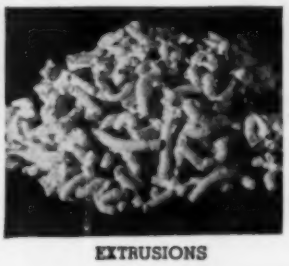
Write today for Level Control Bulletin PF479. B

PHOTOSWITCH INCORPORATED
PHOTO-ELECTRIC & ELECTRONIC CONTROLS FOR EVERY INDUSTRIAL PURPOSE
CAMBRIDGE, MASS. · *District Offices* IN ALL PRINCIPAL CITIES

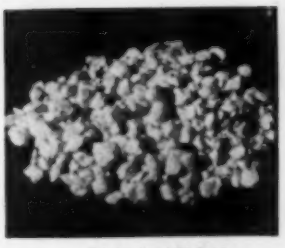
PUBLISHED MONTHLY FOR PROCESS INDUSTRIES EXECUTIVES AND OPERATING PERSONNEL

PREFORMING COMBINED WITH CONTINUOUS CONVEYOR DRYING SPEEDS PROCESSING, INCREASES OUTPUT OF WET SOLIDS

FIN DRUM STICKS


EXTRUSIONS

PREFORMED ON FILTER


GRANULATIONS

PRESSED BRIQUETTES

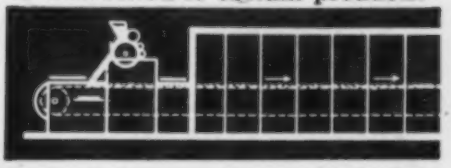
Preforming wet solid materials into small shapes which permit continuous conveyor drying, has made possible the tonnage output of many products which were previously limited to relatively low production.

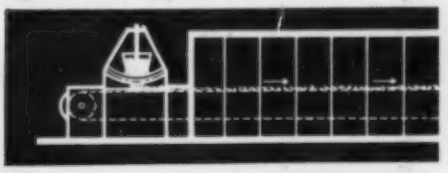
By studying the physical characteristics of any given product and combining this information with capacity requirements — Proctor engineers are able to recommend the method of preforming best suited—and a continuous conveyor drying system of a size to meet the output requirements.

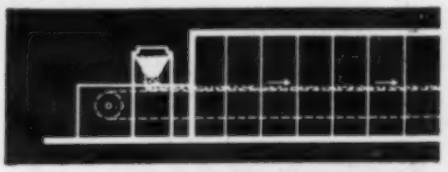
The principle of "preforming" is to take a wet solid material, that would not lend itself to continuous conveyor drying, and convert it into small shapes of uniform size and consistency. These small shapes are then loaded to uniform depth on the constantly moving conveyor of the dryer and carried through the drying chambers. Heated air is then circulated *through* the bed of material; rapid diffusion takes place; drying is speeded, thorough and uniform; case hardening is prevented.

TYPICAL "PREFORMED" SHAPES

FIN DRUM STICKS—Formed by pressing material into grooved surface of internally heated drum where it is partially dried and then discharged in the form of little sticks. EXTRUSIONS—Formed by forcing material through a perforated plate by rolls moving back and forth, and depositing the spaghetti-like extrusions on the conveyor of the dryer. PREFORMED ON FILTER—Formed by scoring the material on the drum of the filter and allowing it to break at the discharge point into reasonably uniform lengths. GRANULATIONS—Formed by pressing material through a screen having a size mesh most suited to the class of granular material being handled. Ideally suited to lumpy or granular materials, as well as hard framed press cake. PRESSED BRIQUETTES—Though not in great use, feed for reducing material to form of pressed briquettes is well suited to certain products.


Fin drum feed, recommended where product must be partially dried to hold a definite shape for conveyor drying.


Rolling extruder feed, recommended where product will hold a definite shape after extrusion, without further moisture reduction.


Granulator feed, recommended for comparatively dry solids. Lumpy or granular materials and hard framed press cake are often preformed by this method.

BOOKLETS TELL COMPLETE STORY OF CONTINUOUS CONVEYOR DRYING

Lucid explanation of the principle of "preforming" and continuous conveyor drying, as particularly applied to the chemical process industries.

Case histories of 11 installations of Proctor continuous conveyor dryers combined with preforming feeds. Complete details on how systems apply to 11 different products.

PROCTOR & SCHWARTZ, INC. 731 TABOR ROAD PHILADELPHIA 20, PA.

AT SHELL DEVELOPMENT COMPANY

NETTCO

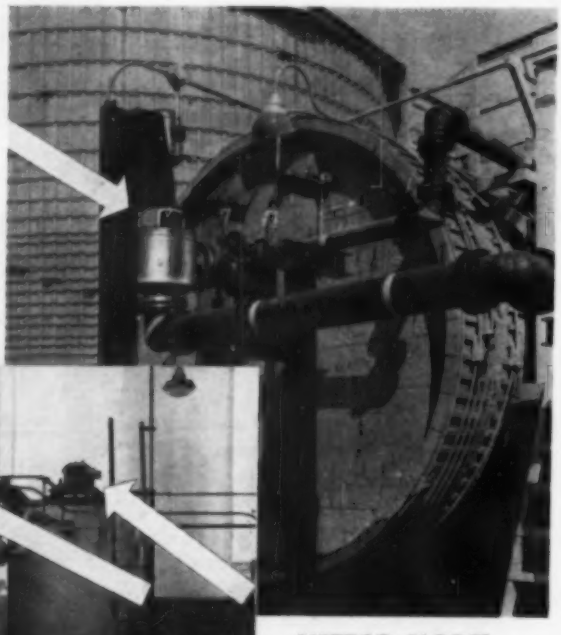
AGITATING EQUIPMENT

Nettco Agitating Equipment renders important service at the Shell Development Company plant, Deerpark, Texas, 1948 winner of the "Chemical Engineering" award of merit. Here, as in other leading plants throughout the country, outstanding achievement and Nettco high performance go hand in hand. For over forty years Nettco Engineers have specialized in improving mixing and blending operations for the process industries. Nettco Agitating Equipment is dependable and efficient — that's why it's the choice of experienced engineers.

NETTCO *Flomix
AT THE SHELL PLANT**

The Flomix* provides continuous mixing of materials entering the process tank. Can be made to combine liquids, gases and liquids, and liquids and solids that will flow through piping.

*Patented



NETTCO MODEL WT AGITATORS AT DEERPARK, TEXAS

Totally enclosed, worm gear agitator drive, equipped with anti-friction bearings. Splash lubrication and positive oil trap assure long life and minimum maintenance on this installation.

There's Nettco Equipment for every agitating need — Let us know your requirements.

NEW ENGLAND TANK & TOWER CO.
87 TILESTON STREET, EVERETT 49, MASS.

ers in government, industry, science and education were present at the dedication. Dr. Karl T. Compton, newly-appointed chairman of the Research and Development Board of the United States national military establishment, and retiring president of Massachusetts Institute of Technology, was the principal speaker at a dinner closing the program.

The new building is part of an $8 million expansion program for research. It is constructed of brick around a steel frame, and is functionally designed throughout to accommodate the exacting requirements of modern research. Movable metal partitions form the laboratory and office side walls so that each room can be altered in size to meet the requirements of the work being done in it. The entire building is air conditioned in such a way as to prevent accumulation of fumes and gases, and contains the most modern safety devices.

Among the problems currently under active study are the conversion of natural gas and coal into liquid fuel, production of higher octane automotive and aviation gasolines for the more efficient engines of the future, new lubricants, and many projects in the chemical field including extension of the quality and use of plastics.

Construction also is proceeding on a motor laboratory, a two-story structure 60 by 90 ft. This laboratory will house 11 soundproof test cells, including one for aviation engines, and will accommodate 20 engines at one time. It is expected to be completed by the middle of 1949.

New Sulphur Dioxide Unit Built by American Smelting

When lead ores are sintered before being smelted, sulphur dioxide is released as a waste gas. One American firm which recovers this byproduct is American Smelting & Refining Co. After some ten years of research, a 20 ton per day liquid sulphur dioxide unit has been put into operation at Selby, Calif. Raw gases, after being recirculated through the Dwight-Lloyd sintering machines, contain 5.5 percent SO_2. They are purified by hot Cottrell, scrubbing towers, mist Cottrell and a coke filter, and are used for manufacture of sulphuric acid as well as liquid sulphur dioxide.

In the SO_2 unit anhydrous dimethylanaline is used as the absorbent. Approximately 15 percent SO_2 by weight can be absorbed by this chemical in an eight-tray column with an efficiency of 99 percent. Absorption and desorption are accomplished in separate 60-ft. steel bubble cap columns protected with a heavy coat of

...proves tops for this job

A sizzling 300°F. to a chilly 45°F.—that's the temperature range of the various conveyor bearings on the brazing oven and cooler illustrated above. Yet Stanobar Grease is used on all 350 bearings in the unit.

This grease has a high melting point, so that on the hot bearings it resists thinning out and does not separate. At the same time Stanobar maintains a smooth, workable consistency on the cool bearings. As a result, all bearings are protected against wear, dirt and moisture at all times.

Stanobar Grease can reduce lubricating cost on the many anti-friction bearings in motors and machines in your plant. Two grades are available, for application either by grease gun or through central lubricating systems. Ask for the services of the Standard Oil Lubrication Engineer in your midwest locality. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANOBAR GREASE

STANDARD OIL COMPANY (INDIANA) STANDARD

no CHEMICAL can attack TEFLON PACKING

FOR PUMPS AND VALVES

• *for example:*

Worthington Worthite pumps installed in the Koppers Company are handling fuming sulphuric acid. They had to be repacked every two days using conventional packing. Since packing with TEFLON Style 101 plastic packing last December, there has been no need to repack.

• *what is it?*

No. 101 Plastic Teflon Packing is a non-porous packing having the 100% chemical resistance of pure Teflon. Thoroughly tested. Withstands temperatures from minus 80°F to 525°F. Style 201 same as 101, except mica is substituted for graphite. This style for stainless steel valves and pumps. We also make Teflon covered gaskets.

• *SO . . .*

wherever, whenever you have a nasty packing or gasket problem, call on

POWER PRODUCTS CO.

11 Broadway, New York 4, N.Y.

bonded lead. Desorbed SO_2 is rectified and cooled, then passed through a steel bubble cap column countercurrent to the flow of 98 percent sulphuric acid. This produces SO_2 of low moisture content. Finished product is compressed, liquefied and shipped to consumers in pressure tank cars. The unit now supplies a large part of West Coast requirements.

Argonne National Laboratory Gets New Home

ATOMIC Energy Commission's "Operation Consolidation" is now under way as scientists and equipment move into a rapidly-built, secluded village of arch-roofed, steel Quonsets to advance research and development vital to American superiority in this field. The ultimate objective, scheduled for 1950, will bring to one guarded site operations which have been in progress at several locations on the Chicago University's campus. The number of employees is expected to increase from the present 1,200 to 3,000.

The new Argonne National Laboratory to which the operations are being shifted is in Du Page County, some 20 miles from Chicago. The project is being operated for the AEC by the University, under a contract entered into two years ago. A future phase will be

THESE **WHITLOCK** HEAT EXCHANGERS LOOK ALIKE . . . .
BUT THEY'RE DESIGNED FOR VERY DIFFERENT JOBS

WHITLOCK HEAT TRANSFER EQUIPMENT

Right IN EVERY WAY

1. Thermal Design
2. Mechanical Design
3. MATERIAL SELECTION
4. Quality Fabrication
5. Cost Economies

It pays to watch these unseen factors

Materials of construction, of course, make a BIG difference in the longevity and efficient performance of a heat exchanger. The problem is to determine the right materials . . . then use them properly. The design of Whitlock Heat Transfer equipment is based on laboratory research and field experience and makes use of the right materials as required by individual operating conditions.

Whatever the material of construction, you can be sure Whitlock Heat Transfer Equipment is engineered and built for optimum results. For prompt service on your heat transfer problems, call one of Whitlock's conveniently located offices or representatives.

THE WHITLOCK MANUFACTURING CO.
94 South Street, Elmwood, Hartford 2, Conn.
NEW YORK • CHICAGO • BOSTON • DETROIT • PHILA. RICHMOND

Authorized representatives in other principal cities.
In Canada: Darling Bros., Ltd., MONTREAL

When You Need MORE CORROSION RESISTANCE

in Handling Sulphuric and Many Other Acids—

Use the *NEW Carpenter* STAINLESS NO. 20

For an Extra Margin of Safety!

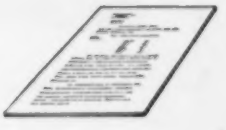
For the first time, this Stainless is available in the forms of bars, wire, strip and tubing.

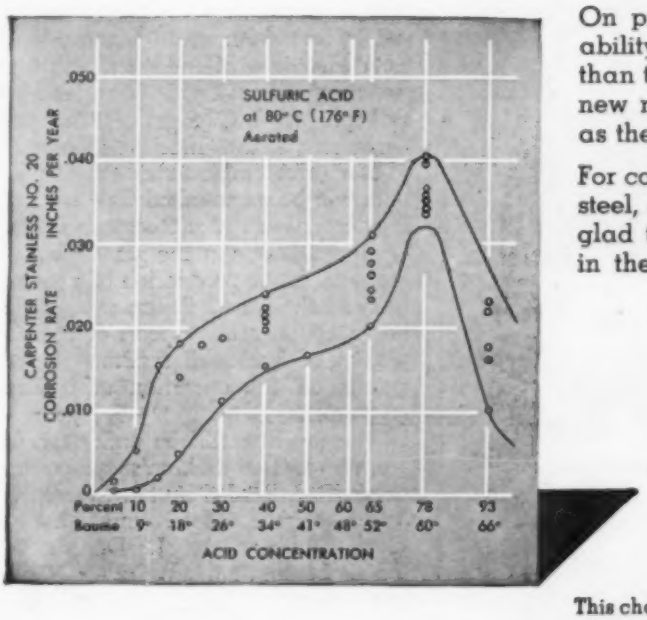
If you are familiar with this alloy in its cast form, known as Durimet 20, you have a good idea of the corrosion resistance provided by Carpenter Stainless No. 20. Now that Carpenter's research has solved the problem of producing this Stainless in wrought forms, the material can take on new and important jobs.

In addition to its excellent resistance to sulphuric acid, Carpenter Stainless No. 20 is well suited for the handling of other acids and corrosive agents. For example, it is used in the handling of acetic, nitric and crude phosphoric acids, black liquor, calcium phosphate, etc.

On production jobs experience has shown that the machinability characteristics of Carpenter Stainless No. 20 are better than those of Stainless Types 316 and 317. Thus, the use of this new material can contribute to fabricating economy as well as the service life of equipment.

For complete information on the properties of this new Stainless steel, drop us a note on your company letterhead. We will be glad to put a set of Carpenter Stainless No. 20 Data Sheets in the mail for you.





This chart shows the ability of Carpenter Stainless No. 20 to resist the corrosive effects of sulphuric acid at temperatures of 80°C (176°F). The danger zone, indicated by the "hump", is in the range of 65-93% sulphuric acid at 80°C (176°F). In this range the conventional 18-8 Cr-Ni-Mo austenitic steels (Types 316 and 317) show corrosion rates many times greater than illustrated here. While Carpenter Stainless No. 20 shows accelerated corrosion, it is far superior to the 18-8 grades and is satisfactory for most of this concentration range.

THE CARPENTER STEEL COMPANY

127 West Bern Street, Reading, Pa.

Export Department: 233 Broadway, New York 7, N.Y. "CARSTEELCO"

Carpenter

STAINLESS NO. 20

Licensed under patents of The Duriron Co., Inc.

TURBO JOINT
For excessive expansion applications.

OFFSET JOINT
For misaligned piping.

But—packless, ringless MagniLastic Expansion Joints take the "gaff"! For *low pressures, high pressures, vacuums, temperature extremes (low or high or variable), volatile gases, corrosive liquids, viscous materials, misaligned piping, and excessive expansion and contraction in confined space,* specify MagniLastic!

They withstand pressures from vacuum to 1000 p.s.i., temperatures from—300° to + 1600°F., fit pipe sizes to 72 inches. You get all-welded construction in such corrosion-resistant metals as stainless steel, Monel, and copper when you specify *MagniLastic.*

Our engineering department is available to analyze your needs, recommend replacements, or help design special units. Call your nearest MagniLastic Distributor or write us direct. Illustrated Catalog M-7 containing additional information, free on request. Act today!

MAGNI LASTIC

A Division of Cook Electric Company, Chicago 14, Ill.

REGIONAL SALES ENGINEERS at Boston, New York, Greenwich, Buffalo, Philadelphia, Pittsburgh, St. Louis, Tulsa, Dallas, Los Angeles.

IN CANADA—Peacock Brothers, Ltd., Montreal.

ANCHOR JOINTS
Straight.

Lateral L.
(also available in Foot L.)

Side T.

Reducing T.

marked by completion of more elaborate structures on which construction is about to begin nearby after months of planning.

Argonne's operations, in which 29 other Midwest educational institutions participate, is the AEC's center for reactor development, associated research and general co-ordination of nation-wide effort. Associated research fields include reactor theory and design, and study and development of necessary materials and components. Construction of a newly-designed reactor, which may be operated at temperatures sufficiently high to make possible production of useful power, is high on the program's priority list.

MIT Site of December ACS Chemical Engineering Session

RECENT advances in the cracking of gasoline and other vital industrial processes will be reported at the 15th annual chemical engineering symposium to be held at the Massachusetts Institute of Technology on December 28 and 29 by the American Chemical Society's Division of Industrial and Engineering Chemistry, it is announced by Prof. Joseph C. Elgin of Princeton University, chairman of the division.

The main emphasis of the symposium will be on so-called fluid process. This technique, it is foreseen, will be of especial value in the gasification of coal and in the production of gasoline from synthesis gas. Papers also will be presented on other aspects of the dynamics of fluid-solid systems, for example, on the operation of cyclone separators.

The meeting will be under the direction of the division's symposium committee, headed by Dr. Lincoln T. Work of the Metal and Thermit Corp., Rahway, N. J. Dr. E. W. Thiele of the Standard Oil Co. (Indiana), Whiting, Ind., is chairman of a subcommittee on technical papers. Prof. Alexander M. Smith II of MIT is head of a group in charge of local arrangements.

New York Chemical Engineers Discuss Tall Oil

WHAT tall oil is, how it is recovered in kraft mills pulping southern pine, the technology of its refining by acid treating or high-vacuum distillation, its industrial uses, its competition with other fats and oils, and its growing commercial importance were discussed by Dr. Arthur Pollak, consulting Chemical engineer of New York, guest speaker at the first fall meeting of the Junior Chemical Engineers of New York City, held at Child's Restaurant,

ENJAY offers a Wide Range of OXYGENATED SOLVENTS and HYDROCARBONS

Whatever you may require in chemicals from petroleum, you can always be sure of uniformity and high quality in products bearing the ENJAY oval trademark. As an affiliate of Esso Standard Oil Company, ENJAY chemicals are backed by the nation's largest petroleum research facilities.

Whether you require a drum or a tank car, our technical consultants stand ready to help you obtain the maximum benefits from *any* ENJAY product, and to help you develop new uses. For complete specifications and information on ENJAY products, write today to:

ENJAY SOLVENTS

PETROHOL* Isopropyl Alcohol (91%, 99%) — $CH_3CHOHCH_3$
Secondary Butyl Alcohol — $CH_3CHOHCH_2CH_3$
Isopropyl Acetate — $(CH_3)_2CHCOOCH$
Secondary Butyl Acetate — $CH_3(C_2H_5)CHCOOCH_3$
Isopropyl Ether — $C_3H_7OC_3H$
Methyl Ethyl Ketone — $CH_3COC_2H_5$

ENJAY HYDROCARBONS

Butadiene — $CH_2{:}CHCH{:}CH_2$
Isoprene — $CH_2{:}C(CH_3)CH{:}CH_2$
Isobutylene — $CH_2{:}C(CH_3)_2$
Diisobutylene — $CH_2{:}C(CH_3)CH_2C(CH_3)_3$†
Triisobutylene — $CH_2{:}C(CH_3)CH_2C(CH_3)_2CH_2C(CH_3)_3$†
† Other isomers also present.

CTLA POLYMER

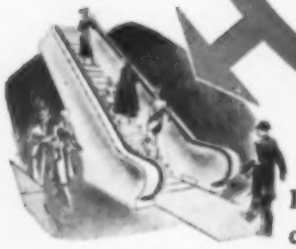
An economical heat-reactive, aromatic-type olefinic hydrocarbon. Highly unsaturated. Dries by polymerization and oxidation. Miscible in all proportions with drying oils. Compatible with most resins.

*Registered Trade Mark

ENJAY

ENJAY COMPANY, INC.
Esso Building
15 West 51st Street, New York 19, N. Y.

C-O-Two helped a leading department store solve a fire protection problem



Fire, even a small one, can spread rapidly . . . create panic . . . loss of good will, equipment, buildings and human lives.

Twenty of the electric stairways at Marshall Field & Company in Chicago are now protected from fire by C-O-TWO. Little chance of cigarette butts, matches, overheated motors, or short circuited electrical equipment starting a disastrous fire. The C-O-TWO Combination Smoke Detecting and Fire Extinguishing System automatically detects smoke in the machinery room and the housing of these electric stairways. Upon a signal, non-damaging carbon dioxide is released into the threatened area, controlling the fire before panic and costly damage takes place.

C-O-TWO FIRE PROTECTION EQUIPMENT INSTALLED AT THE MAIN FIRE STATION
left to right — carbon dioxide cylinders, blowers, control valve cabinet and smoke detecting cabinet.

Whether your fire protection problem is a store, factory, ship or power plant, an expert C-O-TWO Fire Protection Engineer can help you plan and install adequate fire protection equipment.

Write us today for your free copy of the test report on this installation.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

423 Lexington Ave., on the evening of September 30.

A new slate of officers took over at this meeting. They were: Fritz von Bergen, who is in market development with the Westvaco Chemical Corp., president; Clifton C. Sutton, a section head in physical chemistry at the General Foods Central Laboratory in Hoboken, N. J., vice president; Dellason F. Bress, a process engineer in the industrial division of the Foster-Wheeler Corp., secretary-treasurer; and Joseph A. O'Connor, assistant editor of *Chemical Engineering*, assistant secretary-treasurer.

Dr. Pollak, who has been active in tall oil development for 20 years, was formerly director of development of the West Virginia Pulp & Paper Co.

Biggest producer of tall oil in this country is the Arizona Chemical Co., jointly owned by the International Paper Co. and the American Cyanamid Co. Other big producers are the Camp Mfg. Co., Champion Paper & Fibre Co., Continental Can Co., Gaylord Container Corp., National Southern Products Corp., Newport Industries, Inc., North Carolina Pulp Co., Union Bag & Paper Corp. and West Virginia Pulp & Paper Co.

Houdry Introduces New Cat-Cracking Process

Houdry Process Corp. has introduced a new low-cost catalytic cracking process called Houdriflow. This development is an improvement on the Thermofor Catalytic Cracking process which was developed by the Socony-Vacuum Oil Co., Inc., and which has been licensed by Houdry since 1941.

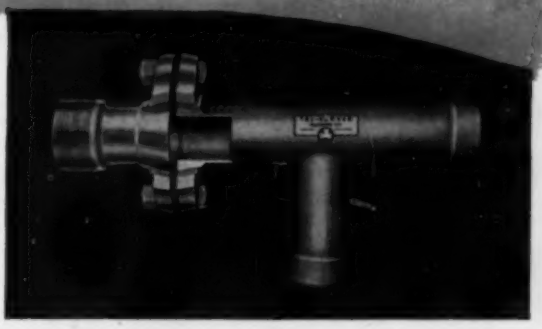
The new design employs a gas-lift principle for raising the catalyst, thereby eliminating the mechanical elevator previously used in the catalyst system. The reactor and kiln are superimposed in the one unit of construction and the regeneration equipment has been simplified and reduced substantially in size, with only one or two zones being required for the regeneration of the catalyst.

Ground area for the construction of the new type TCC is considerably less than that required for the previous design, and construction cost studies disclose a saving of approximately 20 percent. Considerable savings in operating costs are also indicated.

Houdry research and development engineers have for the past several months concentrated on the developments with the cooperation of the Sun Oil Co. engineers.

Sun Oil Co. has already announced plans to install the improved unit as a major part of their $16,000,000 plant

NOW - ONE SOURCE OF SUPPLY...



FLANGED TYPE *Conical End* FITTINGS

... fabricated from stainless steel type 316 for use with commercial tolerance light gauge tubing having outside diameters from 1" thru 10". Easily assembled with lightweight, high strength couplings (as shown), which provide an extremely compact, flush, leak-tight union for working pressures up to 250 psi. Complete line of ells, tees, crosses, adapters, etc., polished or pickled finish.

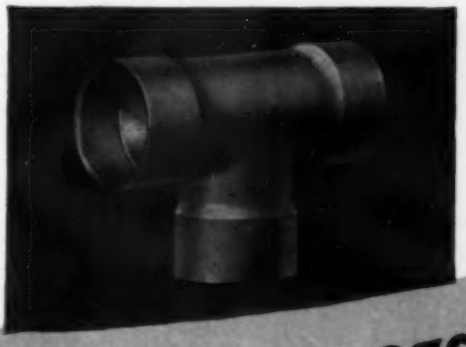
"*Zephyrweld*" WELDING FITTINGS

...in sizes from 1" thru 24" O. D., fabricated in gauges from 16 to 10, for use with stainless steel light gauge O. D. tubing, under broad corrosive conditions requiring semi-permanent or permanent welded line installation. Complete line of ells, tees, crosses, adapters, etc., in stainless steel types 304, 316, 347 ... available polished or pickled finish.

FOR ALL 5 STAINLESS STEEL

"*Sanitary*" TYPE FITTINGS

... available in both stainless steel and nickel alloy in a complete range of fitting and valve types, from 1" thru 4"—Includes all fittings accepted and approved by International Assn. of Milk Sanitarians, U. S. Public Health Service and Dairy Industry Committee.



***Recessed-End* FITTINGS**

... a new, complete line of ells, tees, crosses, etc., for soldering, brazing or welding... provides fast, low cost line installation—available in stainless steel types 304-316-347, in either pickled or polished finish. Sizes from 1" thru 10".

CORROSION-RESISTANT FITTING TYPES!

THE *Wallace* PIPE UNION*

... fabricated from stainless steel type 316, permits the use of thin wall stainless steel tubing in connection with standard threaded iron pipe size fittings of all kinds... saving from 25% to 45% in material without any loss of effectiveness. Available polished or pickled finish.

SEND FOR COMPLETE CATALOGS ... *All 5 types of TRI-CLOVER fittings are fully described and illustrated in individual catalogs. Send for your copies today, mentioning in which of the types you are interested.*

Tri-Clover
MACHINE CO.
Kenosha, Wisconsin

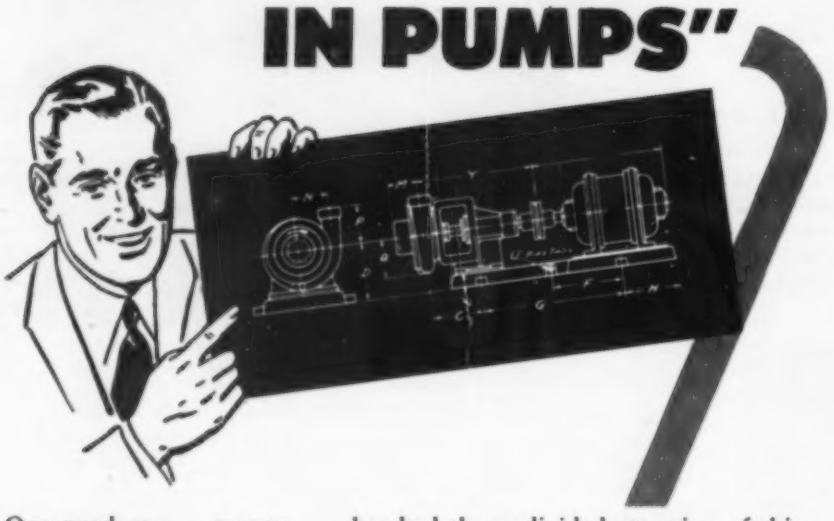
TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

TRI-CLOVER

FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

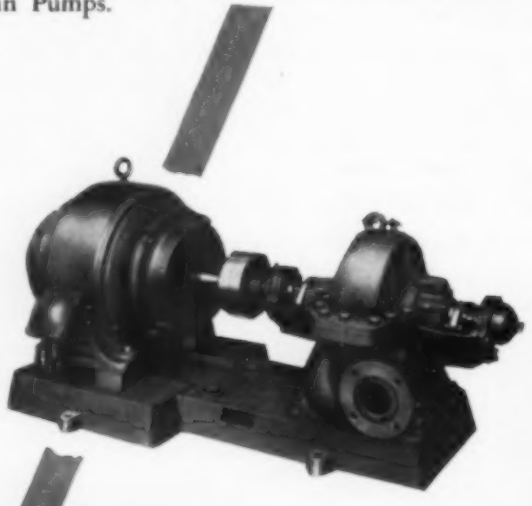
THE Complete LINE

"Career Men IN PUMPS"



One product . . . pumps . . . has had the undivided attention of this company for nearly 60 years. That's why the chemical industry looks to Weinman for help on *any* pump problem. Weinman's advanced methods, creative craftsmanship and "on the job" experience assure you pumps that handle fluids most efficiently. All-Bronze, All-Iron, All-Nickel, All-Aluminum and All-Stainless Steel construction is available in most Weinman Pump modifications and sizes. Whenever you need advice about pumps, it will pay you to write, wire or phone Weinman—Career Men in Pumps.

TYPE JC TWO STAGE SPLIT CASE PUMP — These pumps are of the two stage back-to-back impeller design. The rotating element can be removed without disturbing pipe connections. Capacities up to 600 G. P. M. Heads to 600 ft.



TYPE K SINGLE STAGE UNIPUMP — Type shown has 3" discharge and 10 H. P. 1750 R. P. M. motor. Discharge nozzle may be placed in any of four positions. Available with mechanical shaft seals to prevent leakage of fluid handled.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

298 Spruce Street • Columbus 8 • Ohio

modernization. In addition to the Sun installation, a Houdriflow unit will be installed at the Drumright, Oklahoma Refinery of the Tidewater Associated Oil Co. and the Petco Corp. will install one of the new units at their Blue Island, Illinois Refinery.

Dr. C. C. Peavy, vice-president in charge of engineering; C. G. Kirkbride, vice-president in charge of research and development; and Jack C. Dart, director of development, have been leaders in the development and engineering of the new improved TCC process.

CCDA Holds Session At Mellon Institute

CASE histories in chemical development were featured at the October meeting of the Commercial Chemical Development Association held in the auditorium of Mellon Institute, Pittsburgh. After a welcoming address by Dr. E. R. Weidlein, director of the Institute, five technical papers were presented at the morning and afternoon sessions. Dr. Webster N. Jones, Carnegie Institute of Technology, spoke at the luncheon session on educational training for chemical development.

Dr. M. H. Bigelow, director of Technical Service for the Plaskon Division of Libbey-Owens-Ford Glass Co. presented a paper on the story of Plaskon. Drawing on his own experiences, he pointed out instances where need for products presented themselves, and pointed out how, through the appropriate use of research facilities the problem can be solved. Dr. A. E. Boss, manager of pigment sales for Columbia Chemical Division of Pittsburgh Plate Glass Co., spoke on "Adaptability—a Tool for Production Development." He traced the development of three non-carbon rubber reinforcing pigments. He explained how after four years of research a calcium carbonate product was developed in all particle sizes under four-tenths of a micron and with most of the particles under two-tenths of a micron. However, this material was too costly until 1933 when rubber prices were reduced to the point where lower volume cost of calcium carbonate and its improve tear resistance could be made a feature. Dr. Boss explained how experiments with calcium silicate were originally made to develop a replacement for magnesium silicate in oil decolorization. When this proved unsuccessful the uses in the rubber field were investigated, and it was found that this material had good properties for use with GRS.

Other speakers included Dr. H. B. McClure, vice-president, Carbide & Carbon Chemicals Corp., who pre-

A Big Step Forward!

ALL-METAL CHROMALOX *Electric* RADIANT HEATERS

A New Infrared Heat Source

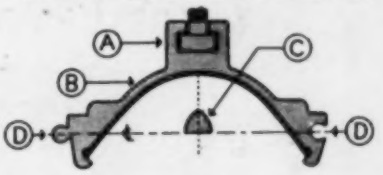
Now—You can use infrared heat in many applications where it has not been entirely practical before. That's because the new, all-metal CHROMALOX Radiant Heaters withstand shock, vibration, dust and moisture . . . they provide glareless infrared radiation in wave lengths which are absorbed almost equally well by all colors, textures and surfaces . . . they operate efficiently in high and low ambient temperatures.

FLEXIBLE IN APPLICATION—CHROMALOX Radiant Heaters are used for infrared drying, preheating, baking, curing, mass-heating, skin-drying, dehydrating and similar applications. Tongued-and-grooved sides facilitate fabrication of heater sections into various working patterns such as banks, tunnels, ovens, etc.

HIGH IN EFFICIENCY—The heat source is an efficient Inconel-sheathed CHROMALOX Tubular element which operates at temperatures of 1000° to 1400° F. It produces uniform and even heat without hot-spots and with a negligible amount of incandescent light. "Alzaked" aluminum reflector sheet gives maximum radiation.

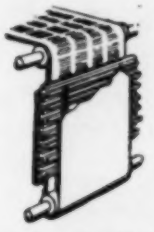
GLASSLESS, ALL-METAL CONSTRUCTION—Extruded aluminum body and shock-proof heating element withstand rough usage; dangers of glass breakage are eliminated. Compact size—4" depth with lengths of 25", 31" and 47". Units come complete with adjustable mounting bolts, ready to install.

QUICK, LOW COST INSTALLATION
EFFICIENT, DEPENDABLE SERVICE

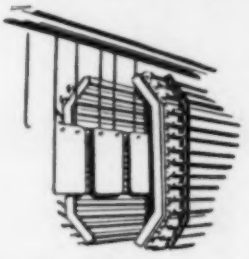


A. Two adjustable captive-bolts per section permit quick and easy mounting into desired position.
B. Extruded aluminum body is equipped with a highly polished, non-oxidizing parabolic reflector for maximum reflectivity.
C. Heat source is high temperature Chromalox triangular-shaped element located to give efficient direct and reflected radiation.
D. Units can be quickly interlocked lengthwise to form straight lines and circular or oval banks of any desired width.

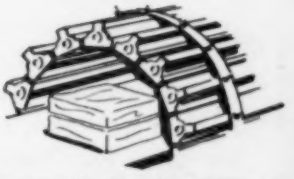
TYPICAL APPLICATIONS:



Single-banks of Chromalox Heaters, mounted in line, bring the efficiency of infrared heat to applications where it was not practical heretofore because of space limitations.



Easily formed, double-banks of Chromalox Radiant Heaters are ideal for line-production. Infrared rays are radiated directly and uniformly on materials being processed.



Sections may be interlocked to form tunnels over conveyor belts; units operate with equal efficiency from all angles. Their glassless construction permits their use in processes and assembly lines which formerly avoided infrared heat because of the hazards of open flames or glass breakage and contamination.

CHROMALOX

Electric Heat for Modern Industry

EDWIN L. WIEGAND CO. · 7514 THOMAS BLVD., PITTSBURGH 8, PA.

Write for Free Bulletin CS-603

It contains complete information and specifications on the all-metal Chromalox Electric Radiant Heaters and shows how you can use these units in your present or projected infrared applications.

IMMERSION HEATING WITH VITREOSIL (Vitreous Silica) HEATERS

When other methods are unsatisfactory, acid solutions in tanks of any material can safely be heated by Vitreosil electric immersion heaters.

Send for Bulletin #2

VITREOUS SILICA — VITREOSIL

THE THERMAL SYNDICATE, LTD.
12 East 46th St. • New York 17, N. Y.

This LAWRENCE Vertical Top-Suction Pump will — pump volatile liquids
— against a high vacuum
— under a low NPSH (net positive suction head)

And, in addition, it cannot get air or vapor bound . . . cause delays and shutdowns.

For pumping out of high-vacuum evaporators, this Lawrence pump provides the answer to all of the technical difficulties involved. Pumping problems like this have been our specialty for eighty-five years. Perhaps we can help you. Write, or phone LAWRENCE 2-4834 — no obligation.

LAWRENCE CENTRIFUGAL PUMPS · LAWRENCE · MASSACHUSETTS

LAWRENCE
MACHINE & PUMP CORPORATION
369 MARKET STREET LAWRENCE, MASS.

sented a paper on "Which Develops First, the Chemical or the Market?" Dr. McClure traced the history of the development on glyoxal which had been known for some time before a market was found for it. He then discussed a case where the need for a product existed but where no known chemical satisfied that need. This was the case of ethylhexanediol. In this case a study of insect repellents pointed to the fact that a particular organic structure would be best suited for repelling insects. Dr. McClure stressed that no matter which comes first, the market or the chemical, successful product development requires a careful coordination between the research staff, the engineer and the salesman.

Dr. E. P. Partridge, director of research and C. R. Texter of the general sales division of Calgon, Inc., presented a paper called "Calgon—a Chemical Development From a Non-Chemical Background." Dr. Partridge read the paper which was a very complete story of the growth of a chemical business which started when a few mechanical engineers tried to repeat the difficulties arriving from boiler scale, in connection with their automatic combustion control equipment. Donald C. Lewis and Robert G. Ruark, Mellon Institute, acted as co-chairmen for the sessions. Dr. Lauren Hitchcock, president of CCDA, announced that the next meeting would be held in Chicago on January 19.

Standard of Indiana Forms Chemical Subsidiary

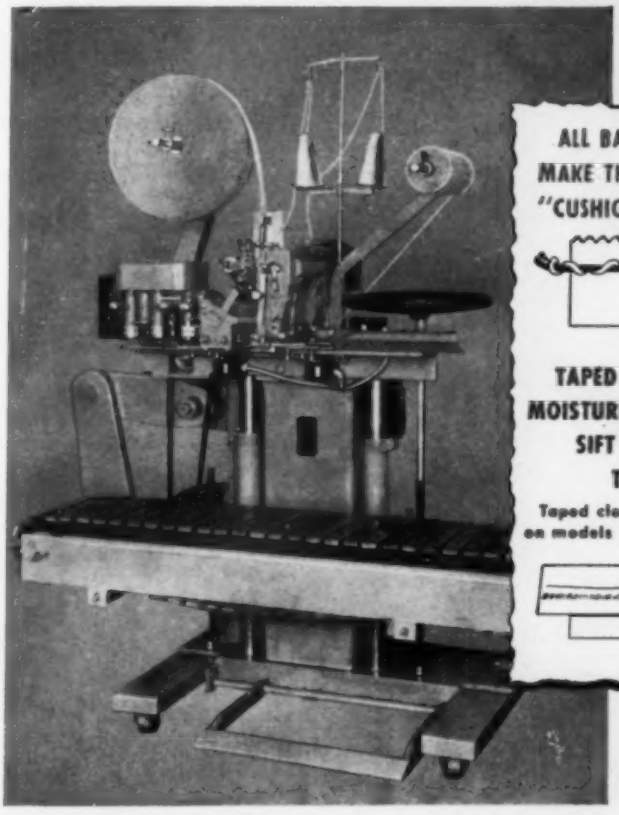
The Standard Oil Co. (Indiana) has formed a wholly-owned subsidiary to handle chemicals. It will be called the Indoil Chemical Co. The present sales and other activities of the parent company's chemical-products department will be taken over by the new company as soon as possible.

Officers of the new corporation include W. B. Plummer, president, and Dr. R. C. Gunness, vice president. H. R. Peterson is to be sales manager. Mr. Plummer has been manager and Mr. Peterson has been sales manager of Standard's chemical products department. Dr. Gunness is manager of research of Standard Oil Co. (Indiana) and will continue in that position. Headquarters of Indoil Chemical will be 910 South Michigan Ave., Chicago, Ill.

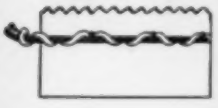
The current program of Indoil Chemical calls for the addition of two new products to its present line of chemicals. One of these is alkanesulfonic acid, a new chemical for use as a catalyst and in other chemical operations. Nonyl alcohol, another new

here's your complete packaging operation!

BY BAGPAK*

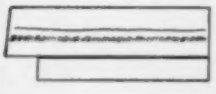


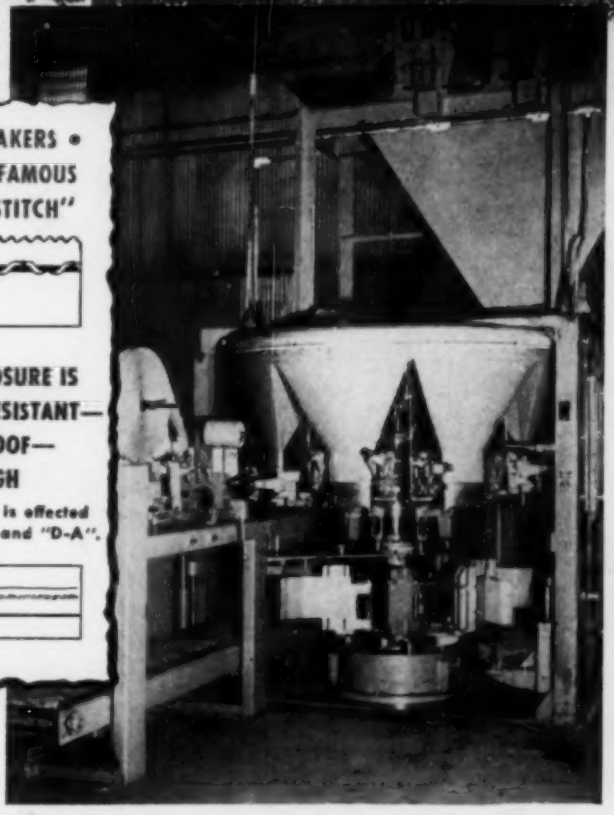
ALL BAGPAKERS • MAKE THIS FAMOUS "CUSHION STITCH"



TAPED CLOSURE IS MOISTURE RESISTANT— SIFT PROOF— TOUGH

Taped closure is effected on models "A" and "D-A".





MODEL "DA" (portable)—One operator, filling and closing, can handle 2 to 4 100-lb. bags a minute . . . 6 to 12 a minute where filled bags are delivered to BAGPAKER conveyor (quickly adjustable for various bag sizes). Starting and stopping of sewing operation is automatic, no tape wasted.

MODEL "A"— Completely automatic — extremely accurate weighing. Saves on "give away" material, labor and bag costs, thus paying for itself quickly. Machine capable of filling and closing 100-lb. bags at the rate of 15 per minute . . . needs one operator.

At absolutely no obligation to you, a BAGPAK engineer will gladly discuss your packaging machinery and multiwall paper bag requirements . . . show you the best methods of weighing, closing and handling bags.

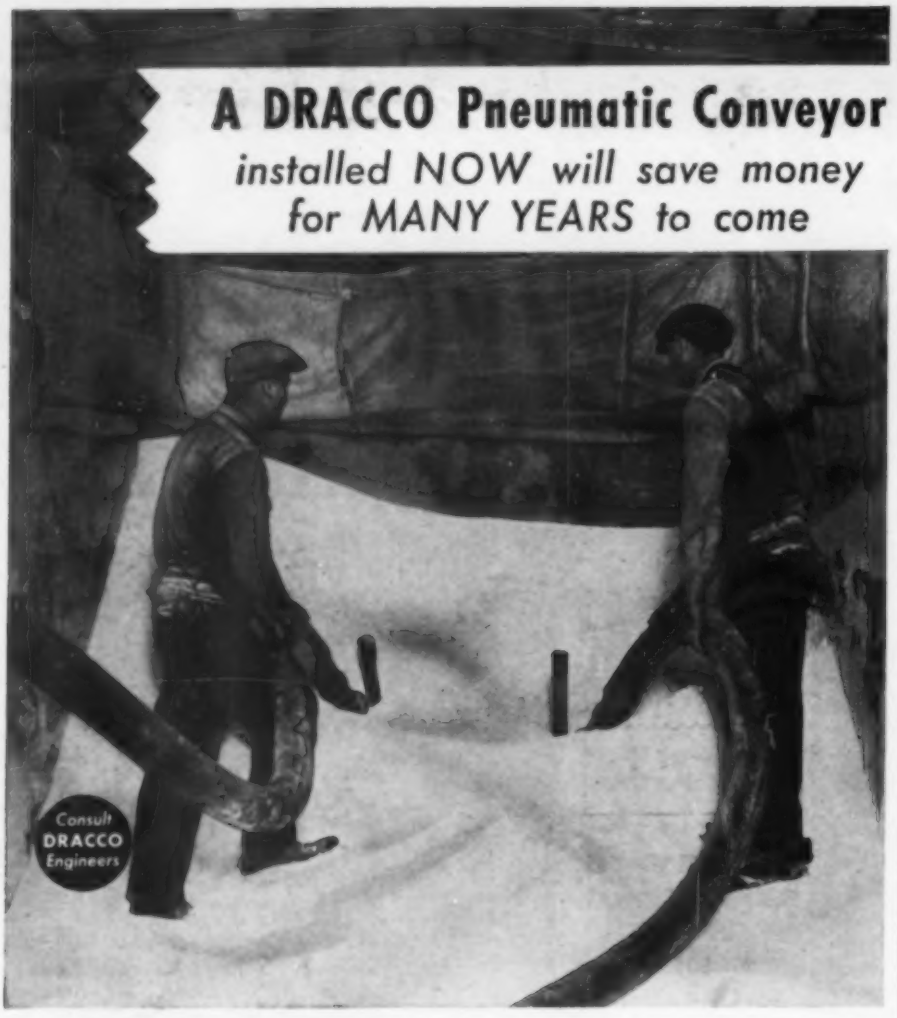
**Manufacturers of famous CUSHION STITCH OPEN MOUTH MULTIWALL PAPER BAGS*

* Reg. U. S. Pat. Off.

BAGPAK DIVISION

INTERNATIONAL PAPER COMPANY
Bagpak Division
220 East 42nd Street • New York 17, N. Y.

***BRANCH OFFICES:** Atlanta, Baltimore, Boston, Chicago, Cleveland, Baxter Springs, Kansas, Los Angeles, New Orleans, Philadelphia, Pittsburgh, St. Louis, Syracuse. IN CANADA: Continental Paper Products, Ltd., Montreal, Ottawa.*



That DRACCO Pneumatic Conveyors save money is an established fact — the amount is what surprises many. In addition to saving labor in handling chemicals, grains and granular materials they save money in many other ways — no loss of material in handling, material may be received in bulk at lower cost, eliminate dust hazards and contribute to better working conditions. One year's saving may not seem too large — but the saving accumulated over the years is immense. Why not let DRACCO Engineers check your handling costs? They have over 30 years experience and have reduced costs for many.

For Further Information Write

DRACCO CORPORATION

4071 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

product, will be in large-scale production in 1949. A wide market is expected for this product as a base for plasticizers.

Lion Expands El Dorado Chemical Plant

LION OIL CO. plans to begin construction in the next few months of two units in its expanding chemical plant at El Dorado, Ark. One project is a $1.25 million sulphuric acid installation designed to produce 300 tons per day of acid. Chemical Construction Corp. of New York City is the general contractor for the design, engineering and actual construction work.

The other undertaking is a $750,000 ammonium sulphate plant designed to produce 380 tons of commercial ammonium sulphate per day. Chemical Construction Corp. has the contract for the design, engineering, procurement of materials and supervision. Blaw-Knox Construction Co. will do the construction work.

Tentative completion dates for both projects have been set for Sept. 1, 1949.

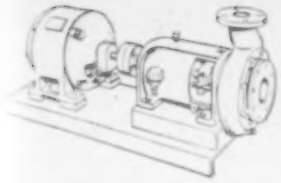
Monsanto Gets $17 million For Texas City Claims

MONSANTO Chemical Co. has announced that it has completed negotiations with the Oil Insurance Association of Chicago whereby Monsanto will receive an agreed sum of $17,312,000 for losses sustained when the plant at Texas City was largely destroyed by the explosion on April 16 last year. This is believed to be the largest single insurance payment in history.

Monsanto originally claimed $21,542,999. In announcing the settlement last month the company said the agreement was a reconciliation of differences of opinion as to the value of properties, the amount of the loss and the interpretation and legal effect of several clauses in the insurance policies involved.

Holly Erects New Sugar Refinery in California

THE new beet sugar refinery of Holly Sugar Corp. at Carlton has completed its first season's run. Plant design is in many ways unique to the beet sugar industry. The factory, located in the so-called earthquake zone, was constructed under the Pacific Coast uniform building code. All main structures are supported on concrete



3 Reasons why I-R Chemical Pumps will give you Better Service

1

They are ARMORED AGAINST CORROSION —with IRCAMET

Ingersoll-Rand chemical pumps are built to stand up under the continuous handling of corrosive and abrasive liquids. All parts of the pump that come in contact with the liquid are made of IRCAMET—a high nickel-chromium-molybdenum alloy steel developed exclusively by I-R for chemical pump service. Laboratory tests and years of field experience have proved its exceptional ability to resist the corrosive action of a wide variety of acids and alkalis. Other materials are available for special operating conditions. The entire unit is further protected against corrosion by special paint which is highly resistant to chemical action.

2

They are PROTECTED AGAINST LEAKAGE —with the LEAKOLLECTOR

The patented LEAKOLLECTOR stuffing-box gland—an exclusive feature of all I-R chemical pumps—provides a simple and effective solution to the problem of pump leakage.

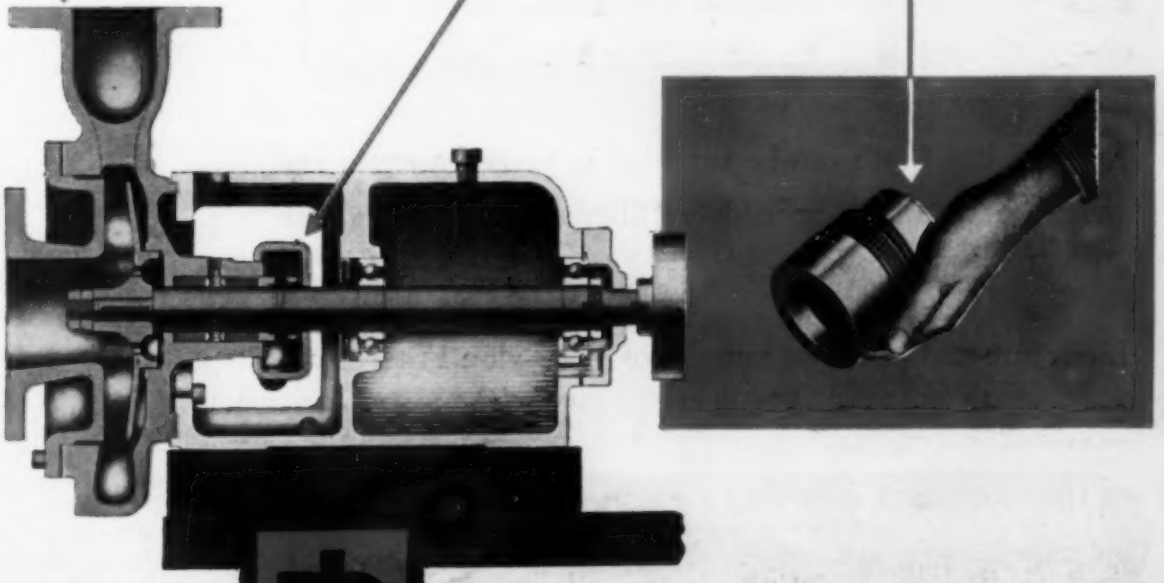
It completely encircles the stuffing box, trapping all leakage so that it can be drained away for collection or disposal. The split gland is accurately fitted to both the inside and outside of the box, and will catch any seepage escaping between the shaft and packing, or between the packing and the bore of the box. The LEAKOLLECTOR is easily removed from the shaft for repacking the box.

3

They are BUILT FOR EASY MAINTENANCE —and LESS OF IT

These pumps are ruggedly constructed to last longer on the job—and the simple design, with all parts easily accessible, means less "time out" for maintenance. The short, rigid stainless-steel shaft prevents impeller whip and eliminates many stuffing box troubles. The suction nozzle is removable, permitting access to the impeller without disturbing the discharge piping.

THE CAMERON SHAFT SEAL can be installed on all I-R chemical pumps to replace the conventional stuffing-box packing. It eliminates stuffing-box leakage and requires practically no attention or maintenance.



I-R Chemical Pumps are of the centrifugal type, of simple cradle-mounted design, coupled to the driving motor. They are available in sizes to handle up to 4000 gpm at temperatures to 800° F.

Ingersoll-Rand

CAMERON PUMP DIVISION

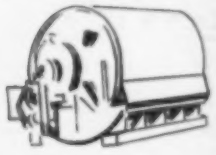
11 BROADWAY, NEW YORK 4, N. Y.

361-10

Nylon FILTER CLOTH

EFFECTIVELY INERT TO...

Most common alkalies	Ketones
Most organic acids	Alcohols
Halogenated hydrocarbons	Carbon Bisulphide
Aldehydes	Carbon Tetrachloride
Benzene	Trichlorethylene



DRUM FILTER

...and offering the following use-advantages

- High abrasion resistance
- Excellent heat resistance; can withstand pressure steam
- Unaffected by Fungi, molds, and bacteria
- Easy cake discharge
- Minimum blinding

PRESSURE FILTERS

Nylon Filter Cloth can be supplied in several weaves and weights and in rolls or made-up filter element covers with all Nylon-Thread sewing.

Literature and pilot test samples of FM Nylon Filter Cloth are available on request.

National Filter Media Co.

Sales Division of FILTER MEDIA CORPORATION

1717 DIXWELL AVENUE • NEW HAVEN 14, CONNECTICUT

SALES OFFICES

Felt Building
Salt Lake City 1, Utah

2627 West 19th Street
Chicago 8, Illinois

1717 Section Road
Cincinnati 16, Ohio

Nicolai Friis
Revierstredet 9
Oslo, Norway

Edward L. Bateman Ltd.
Fox Street
Johannesburg
South Africa

piling. To overcome tropical weather conditions, buildings are of steel frame with protected metal sidings and gypsum plank with composition roofing. A washed-air ventilating system was installed because of the extremely high temperatures that exist during the operating season.

Equipment features include an oil-fired boiler generating 150,000 lb. of steam per hour at 410 psi. and 575 deg. F. The single 3,000 kw. turbine exhausts at 45 psi. to the high-pressure quintuple-effect evaporators. All stations in the house operate on vapors from the evaporators; very little live steam is used. Cossettes from three variable-speed slicers pass over a weightometer to the 21-cell Silver continuous diffuser. Pulp from the diffuser is conveyed directly to a two-unit direct-fired dryer. Instruments and automatic controls are used wherever possible.

The sets of two white, high-raw, and low-raw vacuum pans, all of the calandria type, operate on the first, second and third vapors, respectively. Boiling cycles are staggered to provide an even load on evaporators. The centrifugal station has six white, four high-raw and seven low-raw individually motor-driven, fluid-coupled machines equipped with 40 x 30-in. round baskets. All are automatically controlled. Sugar is dried in a rotor-louvre dryer and stored in four 50 x 106-ft. silos having a total capacity of 20,000 tons. They are equipped with an elaborate ventilating system, including a $CaCl_2$-dehumidifier. Although the factory now operates non-Steffen, provision has been made for a future Steffen-house installation.

Constructed over a period of two years, the plant this season sliced over 200,000 tons of beets, made over 500,000 bags of refined sugar. Design capacity was 2,700 tons of beets daily; operations bettered this by 300 tons.

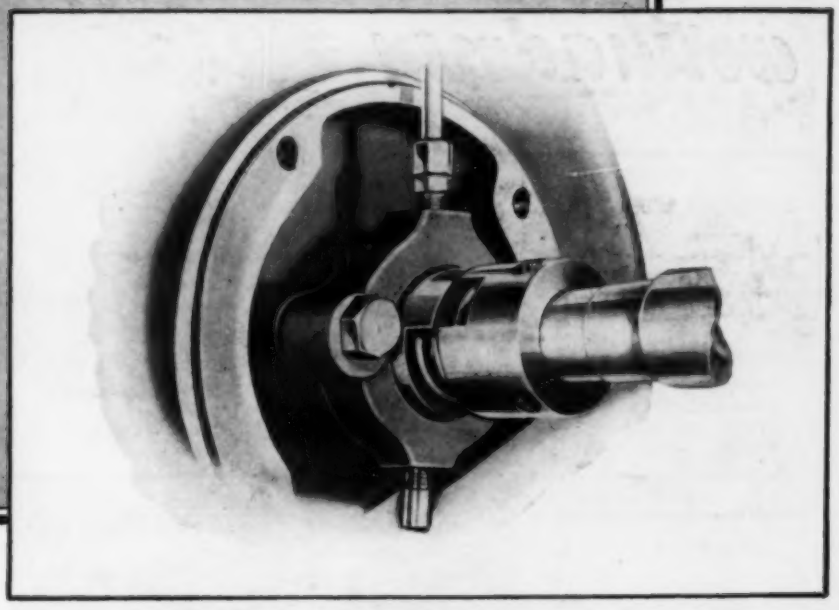
Culligan Ups Zeolite Output in California

A MAJOR expansion has recently been completed at the San Bernardino, Calif., plant of Culligan Zeolite Co. which increases annual capacity to 25,000,000 lb. of synthetic gel zeolite. The plant, built in 1941 and the largest of its kind in the nation, occupies a 125-acre site of which 37 acres is used for dehydration beds. This site was selected because it is near rapidly expanding population centers and because the hot, dry climate is ideal for solar dehydration purposes. During the war, the plant was a large producer of silica gel desiccant for the armed services.

Raw materials are caustic soda from

When Packing Against CORROSIVE LIQUIDS . . .

you can depend on *Worthington Worthite Pumps* equipped with *Type EA Mechanical Seals*



Worthington Type EA Mechanical Seal for Worthite Type CG Chemical Pumps. Three sizes of seals for 23 sizes of pumps.

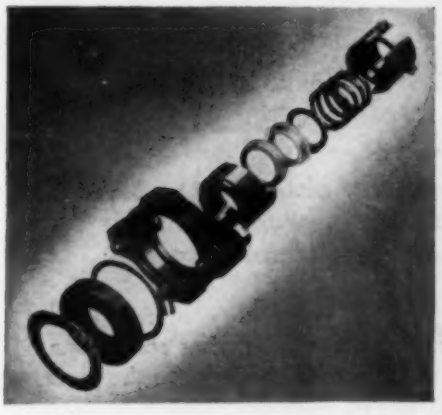
If you have been running into trouble with your stuffing boxes and packings, it's time to consider Worthington Type EA Mechanical Seals. They're especially designed for Type CG Worthite Pumps up to 1200 gpm capacity.

These seals have given outstanding performance in corrosive liquid service. The following distinctive features tell you why:

No stuffing box . . . no packing to replace. Outside assembly . . . easy to apply, simple to repair. No parts churning in acid. All parts made of corrosion resisting material. Pressure is adjustable without dismantling. Single coil Worthite spring. Tongue and groove drive.

Write for BULLETIN W-350-B-10.

For complete details about this Worthington contribution to better pumping of corrosive liquids and further proof that *there's more worth in Worthington* write for Bulletin W-350-B-10. *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*



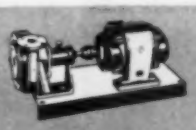
Exploded view of Worthington Type EA Mechanical Seal shows simplicity of this tested solution to tough stuffing box problems.

CGH-1A Worthite pump equipped with Worthington Mechanical Seal in a Southern chemical plant.

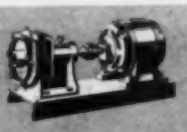
WORTHINGTON

CS-8

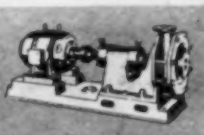
THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



Types CG and CGL. Sizes ¾" to 10". Capacities to 5000 GPM; heads to 200 ft. Liquid ends of WORTHITE alloy.



Type CF. Sizes 1" to 4". Capacities to 1000 GPM; heads to 130 ft. Standard, all iron and all bronze.



Type CQ. Sizes 1½" to 3". Capacities to 600 GPM; heads to 130 ft. at 1750 RPM. Closed impeller. WORTHITE shaft and fittings.

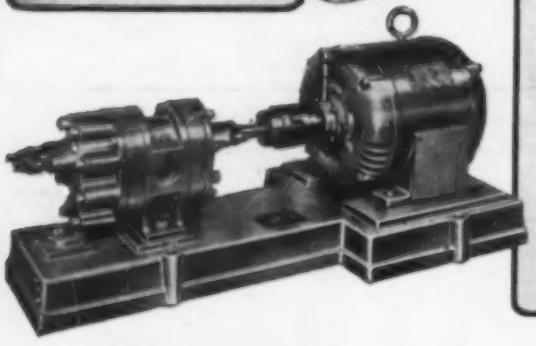
Type L. Sizes 2" to 8". Capacities to 2250 GPM; heads to 300 ft. Single stage volute. For general service.

ONE PUMP working on the job is *worth a dozen* in the repair shop!

SIER-BATH SCREW PUMP

Advantages: • pulseless flow • anti-friction bearings • vibrationless operation • low maintenance cost • rugged construction.

Pumps: Acetate, asphalts, brines, Bunker C Fuel Oil, Cellulosics, Greases, Molasses, Syrups, Lube Oils, etc.



SIER-BATH GEAREX PUMP

• Balanced Axial Thrust • Pulseless Flow • Vibrationless Operation • Roller Bushings for Precision Running under load.

Pumps: Oils, Varnishes, Solvents, Molasses, Chemical Solutions.

Capacities: 1-550 g. p. m.

Discharge: 250 p. s. i. for medium or high viscosities. 50 p. s. i. for water.

The most notable point about SIER-BATH Screw Pumps and Gearex Pumps is their relative freedom from maintenance.

THERE is no mystery about the ability of Sier-Bath Pumps to stand up under the most trying conditions. After all, in such pumps, the worms and gears are the most important parts. And when you consider that Sier-Bath Pumps are made in the best equipped precision gear shop in the country, it is easy to understand their exceptional dependability. Their pulseless flow and vibrationless operation greatly reduce maintenance cost—there is much less wear on valves, couplings and other fittings. Pipes and joints remain tight. With labor costs at their present high figures, these are important points to consider in pump selection. Send for descriptive booklet.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath
GEAR and PUMP CO., Inc.

Henderson, Nev., 42 deg. Be. sodium silicate from Los Angeles, and bauxite from Arkansas. Caustic and bauxite are reacted in gas-fired cookers to form sodium aluminate, which then reacts with the silicate to form zeolite gel. This is poured into the solar drying beds where it remains for 2-4 weeks. After mechanical harvesting, the zeolite is milled, put through a hydraulic classifier, washed by up-flow to remove soluble salts. The drained zeolite, containing 50 percent molecular and surface water, is bagged and shipped to branch filling plants all over the country. Here it is filled into 9 x 44-in. tanks, with a capacity in excess of 20,000 grains of hardness. These are installed in homes in over 2,500 communities by Culligan Soft Water Service franchised operators who offer a complete monthly regenerating services to every customer.

President of the company is E. J. Culligan, a chemical engineer who developed the present method of manufacturing synthetic zeolite about a decade ago. P. H. Sunnes is plant manager at San Bernardino and H. E. Oehler is superintendent. Company headquarters are at Northbrook, Ill.

MCA Issues Data Sheet on Hydrofluoric Acid

HYDROFLUORIC acid is now a common chemical of process industry. This very active agent must be handled with care to minimize corrosion damage and reduce hazard to personnel. Thoughtless methods are not safe.

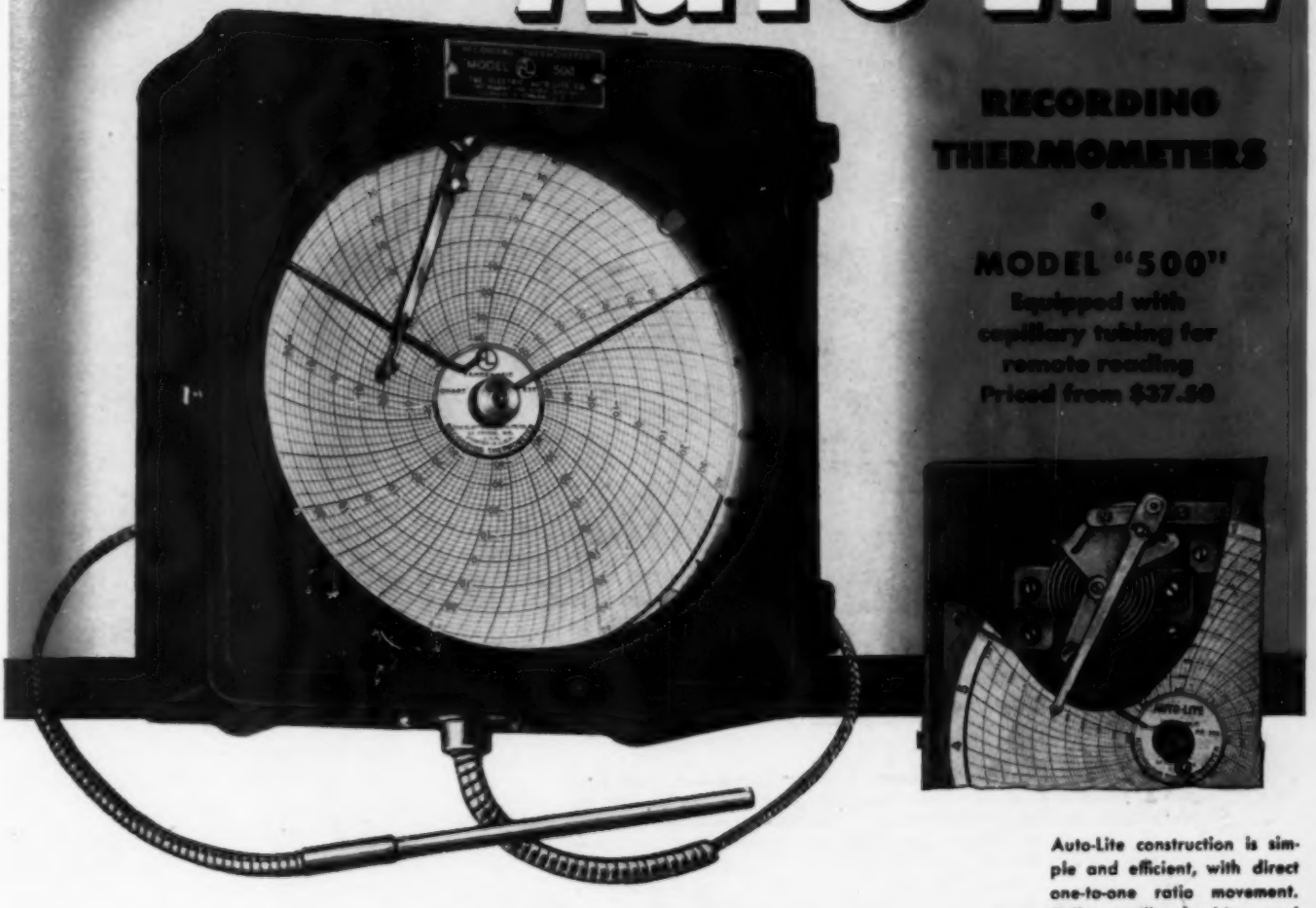
Manufacturing Chemists' Association has taken two important steps toward safety. Its Safety Data Sheet SD-25 describes properties and methods for safe labeling and use. For non-technical personnel handling the chemical in transportation, storage, and factory, there is also a leaflet on "Safe Handling." Members of MCA are supplying the data sheet to technical personnel generally and the "Safe Handling" leaflet to customers as well as workers of their own.

This care for safety contrasts with the proposal of a non-technical producer to sell a water solution of hydrofluoric acid for household use.

Kinsley Making Newsprint From Straw

KINSLEY Chemical Co., Cleveland, Ohio, has developed a process for manufacturing newsprint from straw. Many types of straw pulp have been used successfully in the process, which involves the following steps: the straw is cooked for six hours, then it is refined, and a long thin fiber results; the

. . . DEPEND ON AUTO-LITE



RECORDING THERMOMETERS

•

MODEL "500"

Equipped with capillary tubing for remote reading

Priced from $37.50

Auto-Lite construction is simple and efficient, with direct one-to-one ratio movement. Bulb, capillary tubing and compensated bourdon spring are solidly filled with special heat-responsive liquid under pressure.

This Auto-Lite Recording Thermometer is designed for utmost efficiency and dependability. Its vigilant recording of continuous operating cycles furnishes money-saving proof of temperature behavior during processing and storage. The recorder has 6-inch chart with sub-divisions uniformly spaced, insuring accurate readings throughout the entire scale range. Model "500" Auto-Lite Recording Thermometer is not affected by altitude or by the temperature of the room in which it is located. All readings represent true temperatures at the point where the bulb is inserted. Mail coupon now for full information.

THE ELECTRIC AUTO-LITE COMPANY

INSTRUMENT AND GAUGE DIVISION • TOLEDO 1, OHIO

NEW YORK CHICAGO SARNIA, ONTARIO

AUTO-LITE

INDICATING & RECORDING THERMOMETERS

THE ELECTRIC AUTO-LITE COMPANY
Instrument and Gauge Division
Toledo 1, Ohio

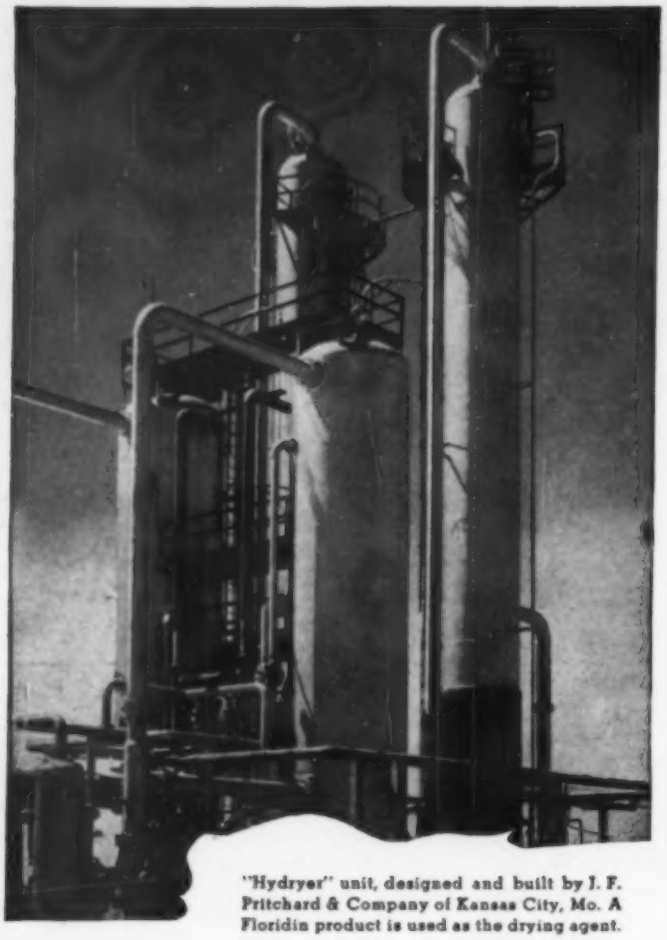
Send your illustrated catalog, describing the various styles and types of Auto-Lite thermometers.

Name.....

Company.....

Address.....

TUNE IN "SUSPENSE," RADIO ADVENTURE AT ITS GREATEST. FAMOUS GUEST STARS. EVERY THURSDAY, 9 P.M., E.T. CBS.



"Hydryer" unit, designed and built by J. F. Pritchard & Company of Kansas City, Mo. A Floridin product is used as the drying agent.

FLORIDIN products, known and approved for more than thirty-five years, have been adapted, by continuous research, for the most advanced modern uses. On any problem of adsorption—dehydration—catalysis—decoloration, you may find an answer in

Floridin ADSORBENTS

including

These Prepared Forms of

FULLERS EARTH

FLOREX · FLORIGEL · FLORAID

and These

BAUXITE-BASED ADSORBENTS

FLORITE (refining grade)
FLORITE (desiccant)

Your inquiry will be given careful attention and a prompt reply.

FLORIDIN COMPANY
ADSORBENTS
Department A, 220 Liberty St. Warren, Pa.

straw is then put through the deckle washer, screen, two bleaches, and the fiber is then cut to the desired length. A closely-formed sheet of paper results, which develops a superior strength.

With straw at $7 a ton, it takes only $14 to make one ton of paper. Further saving is effected by the fact that the time ordinarily required in making newsprint from wood pulp is cut 40 percent.

Oil Shale Progress Described At Wyoming Meeting

THE Synthetic Liquid Fuels Act, among other projects, authorized the Bureau of Mines to create the Petroleum & Oil-Shale Experiment Station on the campus of the University of Wyoming at Laramie. Recently a peek at the inside was given to the public. It marked the completion of authorized research facilities.

Largest and most complete of its type in the world, the oil-shale laboratory will uncover scientific facts which the Bureau hopes will lead to an oil-shale industry. A second function is to prolong the life of the present petroleum industry. To these ends has been constructed a $550,000 building equipped with facilities valued at some $350,000. Research projects of various types are carried on in 33 laboratories. The staff includes 62 scientific and 36 non-technical workers.

Wide scope of the research program may be seen from the findings of studies under way. Both chemical and physical means have been employed in analysis of oil shales; relatively pure kerogen has been prepared by dissolving shale and leaving the kerogen as a residue. In promising retorting experiments, thermal conversion has been combined with solvent extraction. Special extraction, chilling and purification equipment has been used to investigate shale-oil byproducts such as wax, tar bases and tar acids. Other studies are being made in shale-oil refining and analyses, petroleum production and petroleum chemistry and refining.

New Irvington Processing Plant Completed

A PROCESSING plant costing more than $2,000,000 has been completed for the Irvington Varnish & Insulator Co. on Newark Bay by The H. K. Ferguson Co.

One division of the plant will manufacture liners for bottle caps, while the other will process cashew nut shell oil into a number of commercial and industrial products.

The project consists of 13 buildings

SIMPSON *Intensive* MIXERS

improved product quality

increased production

less mixing time

lower mixing costs

IF you mix dry, semi-dry or pasty materials and are interested in a thorough blend in the least mixing time at the lowest cost . . . Simpson mixing-by-mulling is for your plant.

Proved in hundreds of installations — on hundreds of varied products, Simpson Mixers have helped processing plants improve the quality of their product, increase their production and reduce cost.

Simpson Mixers are built in 10 sizes from ⅛ to 50 cu. ft. capacity. They may be equipped with jackets for circulating oil, steam and water as a heating medium and for vacuum mixing — in stainless steel or corrosion-resistant materials. They are self-cleaning and although of batch type they are ideal for continuous systems.

Find out about better mixing — ask for details on a test in National's Laboratory — and invite a National Engineer to discuss your mixing problems. No obligation.

The Mulling Principle of Mixing

In the Simpson Mixer heavy revolving mullers knead and smear the material which is folded over and turned into their path by a set of plows. Action is similar to a mortar and pestle. Pan is stationary. Mixer is self-cleaning.

SIMPSON *Intensive* MIXER

NATIONAL *Engineering Company*

604 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd. Sydney, Australia

with HAVEG

If you need a non-metallic material with physicals such as strength, toughness, and durability PLUS 100% corrosion resistance, investigate HAVEG.

This versatile molded material, resistant to chemical action *throughout its entire mass,* is ideal for structural uses. Tanks, towers, and other large structurally strong equipment can be molded in one piece at nominal cost and delivered in from one to eight weeks.

For complete information on how this unusual material can help improve performance and reduce costs on your applications, drop us a line for HAVEG Bulletin

HA 3-48

HAVEG
CORPORATION
NEWARK 8, DELAWARE

and three tank farms for the storage and blending of process chemicals and cashew nut shell oil. The company has its own dock facilities on the bay which permit economical handling of the cashew liquid. The new plant enables Irvington to more than double its production of liners.

READERS' VIEWS AND COMMENTS

Me Too

To the Editor:

Sir:—We noted with considerable interest the article entitled "Inventory of Midwest Chemical Progress" which appeared in the September issue of *Chemical Engineering.* We were particularly proud to note G. V. Taylor's portion of the report pertaining to the Kansas City Area which appeared on page 141 of this issue. However we were surprised and disappointed to see that no reference was made to our company, which undoubtedly is the largest manufacturer of chemical specialties in this particular area. No doubt this was an oversight, for we are well known in Kansas City and throughout the entire Midwest as manufacturers and distributors of chemicals for agriculture and industry.

L. S. De Atley
Thompson-Hayward Chemical Co.
Kansas City, Mo.

Note: Fields of Thompson-Hayward's manufacturing activity include 2,4-D and other weed killer formulations; insecticides based on DDT, benzene hexachloride, Chlordane, and Toxaphene; a complete series of laundry detergents; concentrated vitamin supplements for livestock nutrition; hospital and industrial germicides; potash soaps; emulsifying agents; mineral mixtures and many specialty products made to customer specifications.—*Editor.*

Part Is Greater Than the Whole

To the Editor:

Sir:—I should like to submit the following as a note to the editor.

The concept of the hydraulic radius has been accepted by the chemical engineering field as a tool for the determination of the effective diameter of flow when fluid flow in non-circular ducts or incompletely filled pipes is encountered. It has been applied to the calculation of Reynolds' numbers and in the estimation of friction heads by use of Fanning or Chezy equations.

A fact, worthy of discussion, has

CONTINUOUS SEPARATION

by Particle Size

BAR-NUN ROTARY SIFTERS

Bar-Nun Rotary Sifters provide continuous separation, by particle size, of dry materials in flaked, granular, or powdered forms. Their high performance efficiency over long periods of continuous use has been proved in years of satisfactory service in process plants from coast to coast.

Available in 3 basic sizes that range from 4 to 60 sq. ft. of cloth surface. Entire screen area available for a single separation, or for two, three, or four separations of the product.

Write for new Sifter Catalog, and complete information on a Bar-Nun Rotary Sifter to meet your sifting or grading requirements.

B. F. Gump Co.

ENGINEERS AND MANUFACTURERS SINCE 1872

422 SOUTH CLINTON STREET, CHICAGO 7, ILLINOIS

ATLANTIC PETROLEUM CHEMICALS

ULTRAWETS

Can you expect ONE surface-active agent to do everything?

No, but there's a type of Atlantic Ultrawet for every job.

The detergency, wetting action, and high foaming of these alkyl aryl surface-active agents have been proved in scores of processes and products. They have increased efficiency, improved quality, and lowered cost in many textile, rubber, leather and other industrial processes, in making cleaners, cleaning compounds and cosmetics.

Some Ultrawets offer a higher concentration of active ingredients than others. They come in the form—liquid, beads or flakes—best suited to your particular requirements.

The check list below indicates the type of Ultrawet that will give you best results:

APPLICATIONS	ULTRAWETS					
Form:	30E Liquid	30DS Liquid	35K Liquid	SK Bead	E Flake	K Flake
Minimum % Solids:	30	30	35			
Minimum % Active-Solids:	85	85	90	38	85	85
EMULSION BREAKING	✓					
LIGHT-DUTY HOUSEHOLD DETERGENTS				✓		
PENETRANT	✓	✓				
INDUSTRIAL DETERGENTS					✓	✓
HEAVY-DUTY HOUSEHOLD DETERGENTS						✓
EMULSIFIER					✓	✓
WETTING AGENT	✓	✓				
CHARGE STOCK FOR SPRAY AND DRUM DRYING			✓			
DRY MIXING WITH ALKALIS				✓	✓	✓
LIQUID HOUSEHOLD DETERGENTS		✓				
COUPLING AND SOLUBILIZING	✓					

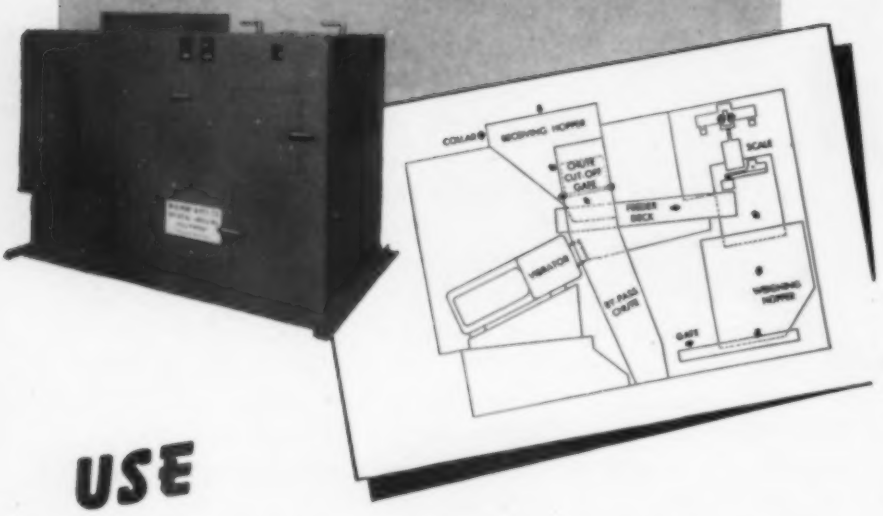
For samples, further information and quotations, wire or write

THE ATLANTIC REFINING COMPANY

Chemical Products Division

260 South Broad Street, Philadelphia 1, Pa.
Chamber of Commerce Building, Pittsburgh 19, Pa.
Hospital Trust Building, Providence 1, R. I.
1112 S. Boulevard Street, Charlotte 3, N. C.
111 W. Washington Street, Chicago 2, Ill.

Speed PRODUCTION . . . Save ON MANPOWER



USE BEAUMONT "Vibro" Automatic Weighing Scales

NOT only speed and savings, but also a more uniform product is assured through the use of a Beaumont "Vibro" scale for the automatic weighing of bulk materials. In processes where exact weights of materials are important for "batches that match", let a "Vibro" scale do the job. The Beaumont "Vibro" scale has no belts, pulleys or motors —a stainless steel vibrating feeder eliminates moving parts and their faults. This design is particularly well adapted to very abrasive materials—and rate of feed can be easily adjusted by a rheostat controlling the vibration of the feeder. Other features include: high weighing accuracy, feeder capacity from 1 to 30 tons per hour, dust proof construction, quiet operation and long life—and we can promise prompt shipment.

SOME OF THE MANY MATERIALS HANDLED BY THE "VIBRO" SCALE

Coal · Alum · Ammonium Sulfate · Lime · Borax
Graphite · Carbon Black · Feldspar · Nitrates · Clays
Ores · Talc · Fullers Earth · Salt · Potash · Chlorides · Sludge · Phosphates · Sulfur · Soap Chips

Write today for descriptive bulletin to:

BEAUMONT BIRCH Company

1510 RACE STREET—PHILADELPHIA 2, PENNA.

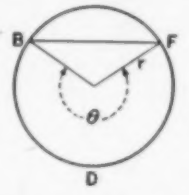
Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

been noted, i.e., the hydraulic radius for a pipe half filled is the same as that for the fluid flowing in the filled pipe (one-fourth the diameter of the pipe). Thus if the linear velocities of the fluid in both cases were equal, application of the hydraulic radius concept to the Fanning equation would indicate that the pressure drop due to friction would be the same in both cases; obviously an incorrect conclusion.

The Fanning equation is $F = fu^2L/2gm$. If it be assumed that the fluid flow is in the viscous range, then $f = 4/mu$ or $F \propto 1/m^2$.

Since the hydraulic radius for a pipe half filled is the same as that for a pipe when filled, a maximum or minimum hydraulic radius should be obtained for a pipe when more than one-half filled and less than full.

A mathematical consideration is as follows:



If A is the cross-sectional area of fluid flow, BDF,

$$A = \pi r^2 - \tfrac{1}{2}r^2(2\pi - \theta) + r^2\cos\left(\frac{2\pi - \theta}{2}\right)\sin\left(\frac{2\pi - \theta}{2}\right)$$

$$A = \pi r^2 - \tfrac{1}{2}r^2(2\pi - \theta) + \tfrac{1}{2}r^2 \sin(2\pi - \theta)$$

where the angle θ is expressed in radians. The wetted perimeter, S, is $S = r\theta$

The hydraulic radius, m, equals (area of stream cross-section)/(wetted perimeter).

$$m = A/S$$

$$m = [\pi r^2 - \tfrac{1}{2}r^2(2\pi - \theta) + \tfrac{1}{2}r^2 \sin(2\pi - \theta)]/[r\theta]$$

$$m = (r/\theta)[\tfrac{1}{2}\theta + \tfrac{1}{2}\sin(2\pi - \theta)]$$

$$dm/d\theta =$$

$$(r/\theta^2)[\theta(\tfrac{1}{2} - \tfrac{1}{2}\cos(2\pi - \theta) - \tfrac{1}{2}\theta - \tfrac{1}{2}\sin(2\pi - \theta)]$$

$$dm/d\theta = (r/\theta^2)[-\tfrac{1}{2}\theta\cos(2\pi - \theta) - \tfrac{1}{2}\sin 2\pi - \theta)]$$

At a maximum or minimum $dm/d\theta = 0$. Therefore,

$$\theta\cos(2\pi - \theta) + \sin(2\pi - \theta) = 0$$

$$\tan(2\pi - \theta) = -\theta$$

$$\theta = 257° 21'$$

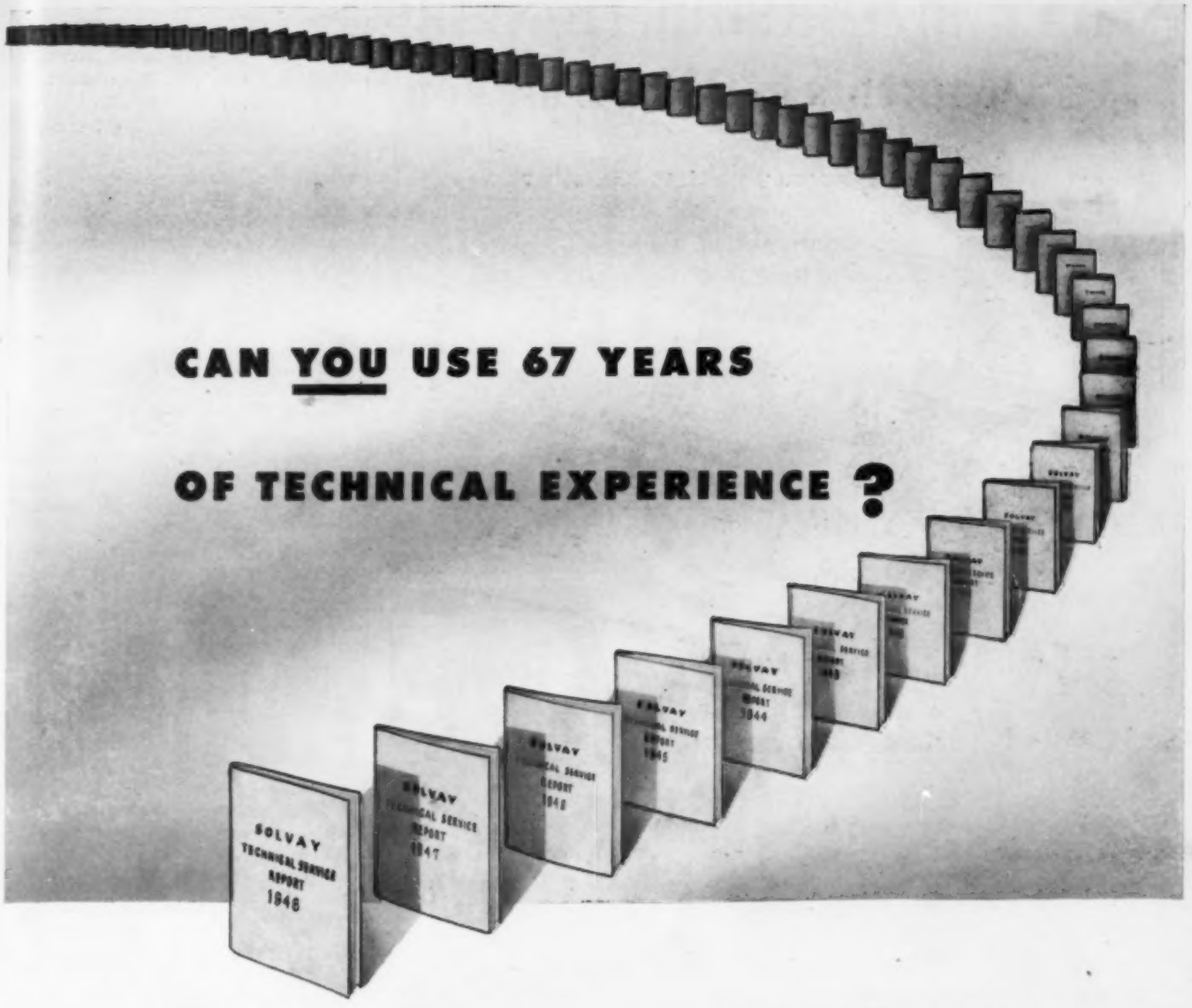
At this condition a maximum hydraulic radius is obtained, $m = 0.6085r$. Thus, from the concept of the hydraulic radius now used, to a great degree indiscriminately, it would appear that the pressure drop in a pipe greater than half filled would be less than if the pipe was half filled. This appears to be a rather incredulous conclusion. I invite further discussion on the matter.

AARON J. TELLER
Assistant Professor
Chemical Engineering
Fenn College
Cleveland, Ohio

In Germany Today

To the Editor:

Sir:—The state of mind of Germans today about Allied Occupying Powers is quite dissimilar from that of 1945. Two alternatives are given:



Solvay—the pioneer alkali manufacturer in America—offers your technical department a *special* type of technical service . . . to help solve your production problems involving the use of alkalies.

Solvay Technical Service—with a background of 67 years of accumulated knowledge and experience—is set up on an "industry-wise" basis. It consists of men who are field specialists in individual industries. For this reason, manufacturing and processing executives have come to depend on SOLVAY TECHNICAL SERVICE They have found that this staff of experts thoroughly knows the individual industry and its complex problems.

Put this specialized talent to work for you the next time you have a production problem involving alkalies and associated chemicals. Let a SOLVAY TECHNICAL SERVICE field specialist *in your industry* help you find the right answer. There is no cost or obligation . . . and the strictest confidence is assured.

Industry-Wise
SOLVAY Technical Service
Individual Industry Specialists to Serve You

SOLVAY SALES DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

BRANCH SALES OFFICES:
Boston • Charlotte • Chicago • Cincinnati • Cleveland
Detroit • Houston • New Orleans • New York
Philadelphia • Pittsburgh • St. Louis • Syracuse

WHAT SIZE REDUCTION JOB can this mill do for you?

Because of its versatility and rugged construction, the Sprout-Waldron Double Runner Attrition Mill is already well established in the process industries. Sketches of actual product samples show its wide range of application.

Interchangeable grinding discs and other variations allow this same unit to shred, granulate or pulverize. Such flexibility makes the Attrition Mill one of the outstanding machines in our broad line of size reduction equipment.

It's another reason why processors continue to rely upon Sprout-Waldron for sound recommendations in problems of size reduction.

Write Sprout-Waldron & Co., Muncy, Pa.

SPROUT WALDRON
Manufacturing Engineers
MUNCY PENNSYLVANIA

the Western and the Eastern side. It is a fallacy to suppose that the German population in the Eastern Zone is in the majority pro Russia. But whatever German opinion of the Russians personally may be, there seems no doubt that among many Germans exists the feeling that if they prove themselves deserving, the Russians will help them to revive a new Germany. The majority of the firms in the Russian Zone are Soviet Aktien Gesellschaften (SAG's or Soviet-owned companies) and so called Volkseigene Betriebe (Volks-owned factories). While the SAG's directly are controlled by Russian officials, usually designated as nominal directors and share holders, the Volks-owned factories without exception are in hands of German convinced Communists. That means that the whole economic system of the Eastern Zone is entirely directed by Russian Communist policy. So the whole economy of the Eastern Zone, directed by Russian policy, is made an instrument of Communist aims with the possibilities of their further extension.

In opposition to the Eastern Zone of this country, in the U. S.- and the other Western Zones there exists a free economy. As a consequence of the democratic spirit in these Western Zones, there is an economy which may and does have a strong influence on German political opinions and through which finally the whole policy may be directed. History shows that after the Red Revolution of Russia many Germans did their best to be good democrats as long as German economy inclined to the West. Later the influence of the East became stronger and stronger and German political minds had a tendency to swing over to the Communist side. But in spite of some thoughts beginning to look for guidance to Moscow, it was proved that the whole bulk of German opinion did not welcome Communism. Therefore there was little opposition to Hitler's anti-Communist campaign. It is a very great pity that the power that was given to Hitler was used so much for evil and so little for good.

Today the effects of the Russian policy in Germany should not be underestimated. The existence of an increasing privileged political class brings forth opportunistic "yes men," just as did the Nazi party. Now with the decision whether the Germans will turn to the Western side or to the Eastern side lies within the hands of the United States of America. The time has now come for either side to establish an economy that will sway the whole German Nation.

HARRY SCHOEFL
Berlin
Germany

DEOXO PURIFIERS
PROVIDE
OXYGEN FREE GASES
FOR

HEAT TREATING
ANNEALING
BRAZING
HYDROGENATION
SINTERING
SOLDERING

DEOXO GAS PURIFIERS provide a simple and dependable means for removing Oxygen or Hydrogen from such gases as Argon, Helium, Nitrogen, Hydrogen, Neon, Oxygen, Carbon Dioxide and Saturated Hydrocarbons.

MODERN CATALYTIC METHOD
OPERATE AT ROOM TEMPERATURE
REQUIRE NO POWER SUPPLY
NO MAINTENANCE OR UPKEEP EXPENSE
RESIDUAL IMPURITY LESS THAN ONE PART PER MILLION
STANDARD UNITS
5 c.f.h. to 100,000 c.f.h.

Deoxo Indicators for Continuous Measurement and Recording of Oxygen Concentration in Gases Are Also Available.

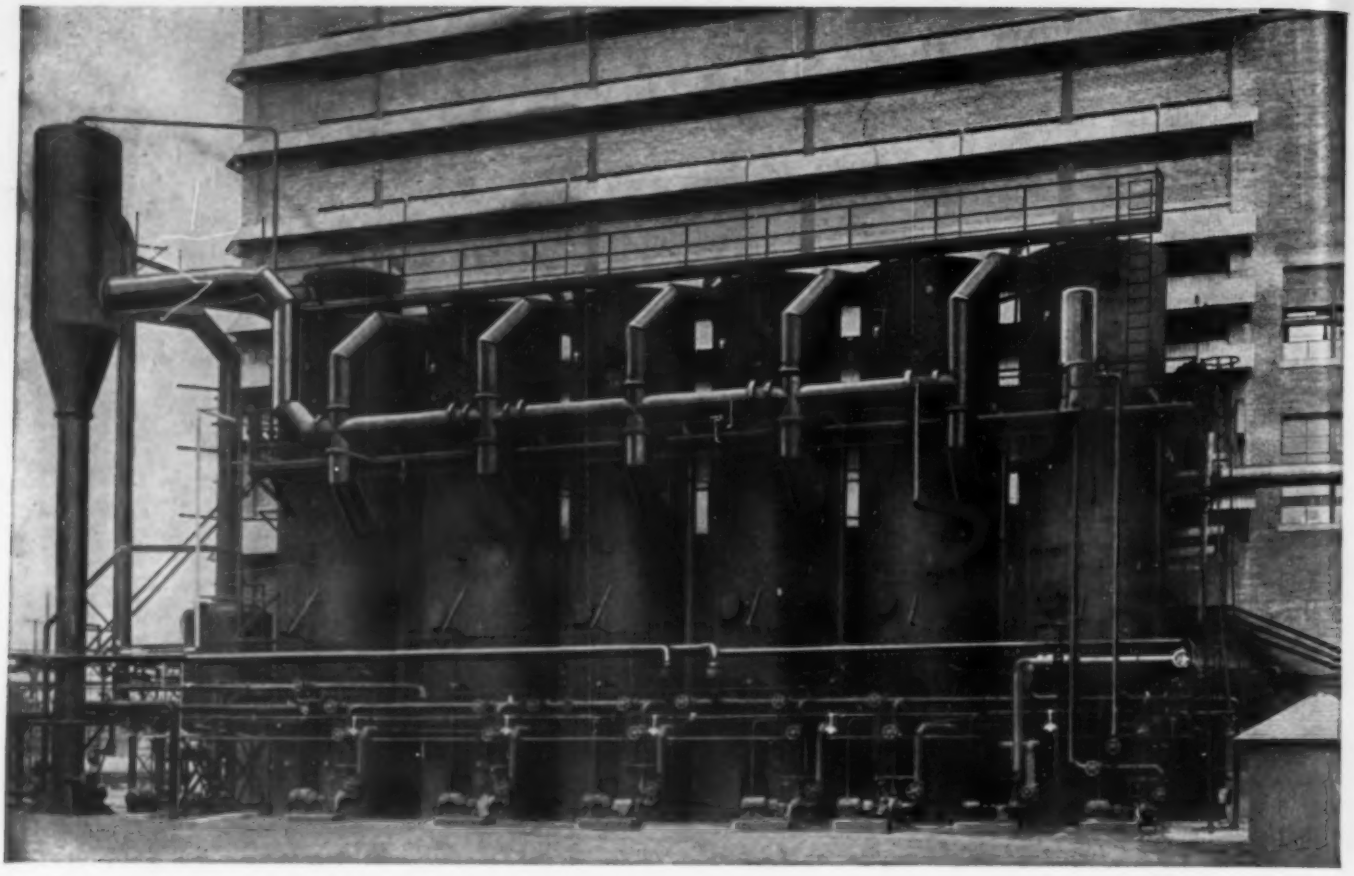
CATALOGUE AND COMPLETE INFORMATION ON REQUEST.

20,000 C.F.H. CAPACITY
DEOXO GAS PURIFIER

BAKER & CO. INC.

113 Astor St., Newark 5, N. J.

NEW YORK CHICAGO SAN FRANCISCO TORONTO



One of the largest SINGLE EVAPORATOR INSTALLATIONS in the U.S. is at the new plant of the SOUTHERN PAPERBOARD CORPORATION

Containing 63,000 sq. ft. of heating surface, this unit—a Conkey Self-Supporting Sextuple Effect Long Tube Film Type Evaporator—is concentrating black liquor.

The Conkey Self-Supporting Type was chosen because of the following features—

- Low installed cost.
- Greater capacity per square foot of surface.
- Lower pressure drop between effects.
- Simplicity of operation.
- Goes on the line quickly.
- Reduces overall down-time.

Other types of Conkey Evaporators for use in the chemical industries include, Long Tube Film Type, Long Tube Vertical Recirculation, Vertical Tube Forced Circulation and Submerged Tube Forced Circulation.

Other GENERAL AMERICAN EQUIPMENT

DEWATERERS
DRYERS
EVAPORATORS
THICKENERS
KILNS
TANKS
TOWERS
BINS
TURBO-MIXERS

GENERAL AMERICAN TRANSPORTATION CORPORATION

Process Equipment Division

SALES OFFICE: 10 East 49th St., Dept. 800 New York 17, N. Y.

WORKS: Sharon, Pa., East Chicago, Ind.

PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

OFFICES: Chicago, Cleveland, Louisville, Orlando, Pittsburgh, St. Louis, Salt Lake City, Sharon, Washington, D. C.

NEWS FROM ABROAD

Special Correspondence

McGRAW-HILL *World News*

Argentine slashes newsprint imports . . . Salt mines active in India . . . Anzacs to get phosphates from Christmas Island . . . Teflon coming to Britain.

Argentina Cuts Newsprint Imports in Half

BUENOS AIRES—Argentina has ordered a 50 percent reduction in the import of newsprint because of exchange difficulties.

Imports normally come from Scandanavia and Canada, both of which countries are demanding "hard" currencies in payment for newsprint.

At the same time, the National Economic Council of Argentina has under consideration proposals to produce newsprint domestically in Argentina. Several kraft paper factories operate in Argentina at present, but none are capable of turning out newsprint.

Zinc Hydrosulphite Brightens Eucalypt Pulp

MELBOURNE—Australian Newsprint Mills Ltd., Boyer, Tasmania, is successfully using zinc hydrosulphite to brighten the reddish brown mechanical pulp from Tasmanian eucalypts. Although the treatment has been successfully applied in Canada to conifer wood pulps, this is perhaps the first commercial application in the hardwood field. The treatment also deals successfully with the bluish discoloration caused by contact of hardwood sap with iron. The hydrosulphite solution is added soon after the pulp leaves the grinders and while it is still at a temperature of 140 to 150 deg. F.

Production of hydrosulphite at Boyer involves the following steps: (1) Melting and burning of raw sulphur to form sulphur dioxide and absorption of the cooled gas in water to form dilute sulphurous acid of 1.4 to 1.8 percent SO_2. (2) Expulsion of SO_2 from the dilute acid by application of steam, giving an SO_2-rich gas. (3) Reabsorption of SO_2 in water to give a stronger sulphurous acid of 5.2 to 5.5 percent SO_2. (4) This is made to react on zinc dust, forming a 4.5 percent zinc hydrosulphite solution ready for storage. Because of the unstable nature of the hydrosulphite and its readiness to oxidize, the solution in the storage tanks is kept covered with a layer of oil.

Activity at Salt Mines Pushed in India

NEW DELHI—The government has asked salt manufacturers to try to increase efficiency of production in order to boost the country's output another 10 percent. The request follows a report by a government committee that "a little extra attention" by the producers would make the increase possible.

The situation is that at present Indian salt production is roughly 4 billion pounds per year. But India's requirements for human consumption alone are on the order of 5 billion pounds and the needs of chemical industries and agriculture are estimated at another 2.5 billion pounds.

Australia and New Zealand Buy Phosphate Deposits

MELBOURNE—To bolster their dwindling overseas supplies of phosphate, the governments of Australia and New Zealand have jointly acquired the workings of the Christmas Island Phosphate Co., 200 miles south of Java.

Like South Africa, the third Southern Hemisphere dominion, Australia and New Zealand are among the world's phosphorus-starved farming nations. The principal prewar source of their phosphate supplies was Nauru, the once German South Sea possession. Bombed and shelled in turn by German, Japan and the United States in the 1939-45 war, the island's phosphate workings are only slowly returning to normal production. Both Australia and New Zealand have been scrounging phosphate from scattered islands of French Oceania to eke out supplies, and New Zealand has been substituting a low-grade domestic phosphate mineral for the high-grade imported rock.

From December 1, the two dominions won't have to worry much more about supplies of this vital fertilizer. From that date they will jointly take over the 30,000,000 tons of phosphate rock deposit which has been worked by the Christmas Island Phosphate Co. on the small (62 sq. mi.) island. Administratively, Christmas Island is part of the Federated Malay States.

Probably there are other motives behind this acquisition which sets the two governments back by $9 million.

Christmas Island is the final target for the Australian long-range guided-missile project. It will be necessary to provide facilities for a technical "reception committee" to take delivery of the rockets after their 3,000-mile flight from Central Australia.

Polytetrafluoroethylene Now Being Produced by British

LONDON—Now the British can have polytetrafluoroethylene. Last month British Mechanical Productions Ltd. announced that it is making use of polytetrafluoroethylene for a number of applications where the plastic's high heat resistance and its other exceptional qualities, including complete indifference to moisture, are required.

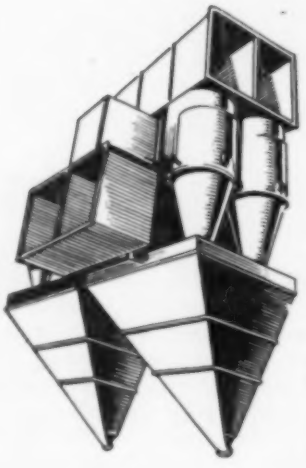
BMP is molding the plastic at present into radio tube-holders, cathode-ray tube-holders, wave-guide components, condensers and resistors—which will find their most immediate use, certainly, in airborne radio and radar equipment where temperatures run highest.

Polytetrafluoroethylene is a development of Du Pont, which Imperial

PRACTICAL
dust
RECOVERY

can be a reality

. . . if you logically consider the problem. Too few dollars can easily buy disappointing efficiency while it is just as possible to over-invest with the same result. That's where the Buell van Tongeren Cyclone comes in. With a patented "Shave-Off" to overcome the "double eddy" evil, it can be big enough to overcome plugging hazards. Individually engineered for each specific application Buell is in a class apart in achieving high fractional efficiencies. There's convincing data in the 1948 Buell catalog. Write to: Buell Engineering Company, 18 Cedar Street, Suite 5000, New York 5, N. Y.



buell

Engineered Efficiency in DUST RECOVERY

Chemical Industries Ltd. will produce in its sphere under the interchange agreement between the two companies.

ICI is making polytetrafluorethylene as a molding powder, but only in small quantities at present, on a pilot-plant scale in the company's general chemicals division in Lancashire. (Factories are at Widnes and Runcorn, on opposite banks of the Mersey River upstream a few miles from Liverpool.)

The project, as far as ICI is concerned, is a natural outgrowth of the general chemicals division's fluorine development work. While it is more probable that polytetrafluoroethylene will evoke a demand that will call for large-scale production eventually, ICI says it is too early to confirm this or to discuss plant construction for this purpose.

Initial British development of polytetrafluoroethylene as a molding material was done by the Royal Aircraft Establishment at Farnborough, with British Mechanical Productions taking over in the later stages.

Monsanto Expanding Chemical Output in Australia

THE Monsanto (Australia) Pty. Ltd., which is jointly owned by American, British and Australian interests, has added sulfamerazine to the line of sulfa drugs made by Monsanto in Australia.

A second plant to produce phenol-formaldehyde plastics has been completed.

On completion of the Cardiff, Wales, plant, products of the English Monsanto Co. will become available in Australia. These will include Syton, for use in wool spinning; pentachlorphenol, the timber preservative; polystyrene plastic molding materials; and synthetic detergents and wetting agents.

South African Firm Expands Its Activities

THE African Explosives and Chemical Explosives Ltd. has decided to assist chemical research in South African universities. It has instituted seven research studentships in chemistry and chemical engineering and two in entomology.

Award of these studentships is left to the universities, so that the main object of encouraging the training of promising graduates in methods of research may be achieved, and the development of research schools in universities is encouraged. The company has also granted £1,500 to the Council for Scientific and Industrial Research

things are on the move at SIVYER

Big things are happening at Sivyer! Rushing to completion is a new building program—so Sivyer can serve you even better.

There's expanded foundry capacity for high alloy casting . . . new induction melting furnace facilities . . . new grades of alloys including Sivyer 20 (same as Durimet 20 and made under license from Duriron Company) . . . new service for electro-polishing of stainless castings . . . *plus* faster deliveries.

Now, more than ever, you should make Sivyer your source for quality corrosion-resistant steel castings.

SIVYER STEEL CASTING COMPANY
MILWAUKEE 51 CHICAGO 51

for a lightning research fellowship. In co-operation with the Bernard Price Institute, methods of providing protection against lightning and warnings of it will be investigated. This work will increase safety in manufacturing explosives.

The firm has also decided to build a nitrogenous fertilizer plant at an estimated cost of £2,000,000. It will be capable of producing 26,000 short tons of ammonia a year, in addition to the output of existing plants. Sir Ernest Oppenheimer, chairman of the company, estimated that with the new plant producing, South Africa will be self-supporting for her nitrogen requirements for industry and agriculture.

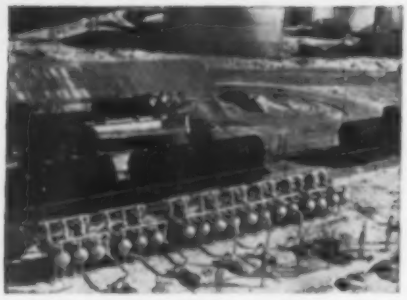
The company is also investigating the possibilities of manufacturing plastics in South Africa, but it is being cautious in view of rapidly-changing techniques in plastics.

Britain Still Faces Problems in Dollar Exchange As Imports of U. S. Chemicals Grow

LONDON—British chemical imports have been rising rapidly in the last few years, and the authorities are beginning to feel some concern about the high dollar expenditure involved. Unfortunately, there are few short-term remedies which might be applied to solve the immediate problem. More attention is therefore being paid to long-term measures to reduce Britain's dependence on chemical imports.

The British isles are amply provided with coal, salt and limestone, to say nothing of many minor raw materials for chemical manufacture, but utterly dependent on foreign supplies for crude fertilizer materials, most metals and minerals, many dyeing and tanning materials, essential oils, medicinal herbs, drugs, petroleum and also some acids, pigments, gas blacks, calcium carbide, tartrates and other chemicals. Some of these are now being made in small quantities by British producers, but the bulk of the supply comes from abroad.

The total cost of imports of raw materials for chemical manufacture and chemical products for direct use in other trades may be running at an annual rate of £50,000,000 or more. In the official returns imports of "chemicals, drugs, dyes and colors" (which by no means include all chemical materials) were shown at £15,900,000 for the first six months of this year, com-



EXCEL-SO

SEPARATORS

Solve The Problem

Eight products filtered and scrubbed before loading into trucks or tank cars with 18-HP-300 (300 GPM) EXCEL-SO Separators. Standard Oil of N. J., Moorehead City, N. C., Marine Terminal.

USE THIS COUPON

WARNER LEWIS COMPANY

BOX 3096C · TULSA, OKLAHOMA

Send me complete information re: Separating Units

EXCEL-SO

Name _____

Street _____

City _____

J&C ZENITH CONTINUOUS PULP PRESS

JACKSON & CHURCH COMPANY'S ZENITH CONTINUOUS PULP PRESS offers GREATER efficiency and GREATER profits . . . with the hydraulically operated cake discharge port or "floating cone."

Long the finest dewaterer on the market, Zenith's new 100% automatic operation assures CONSTANT, UNIFORM discharge pressure at any pre-determined degree. Finger-tip adjustment assures drier cake of uniform consistency.

These engineering triumphs . . . found only in Zenith Press . . . are available to paper pulp, cannery, corn starch, fish reduction, meat packing, glue, citrus waste drying and many other processes.

For further plant uses, for individual problems or for engineering or additional data, write Jackson & Church Company at Saginaw, Michigan.

A PRODUCT OF

JACKSON & CHURCH COMPANY, SAGINAW, MICHIGAN

"Work well done since '81"

leed stainless or heat-resistant sheets?

REMEMBER INGERSOLL ROLLS ALL 3!

ENGINEERING B-W PRODUCTION

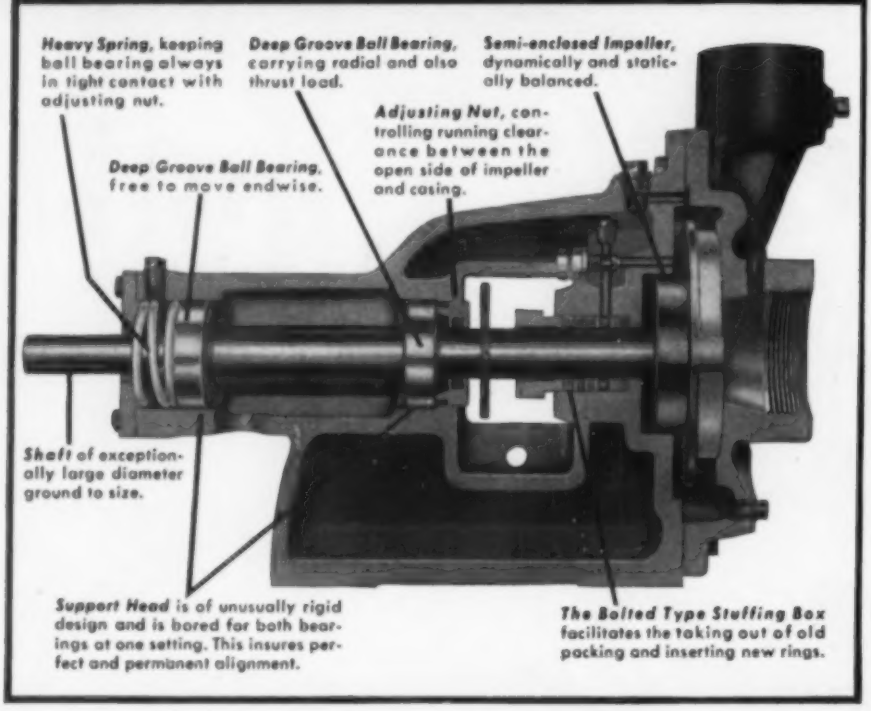
Most users of Stainless-clad steel know the 20-year record of IngAclad. Countless applications in all of the Process Industries have proved its dependability and real economy. Where protection has been needed on *both* sides of the metal, Ingersoll sold stainless sheets have also had wide acceptance.

But do you know that Ingersoll heat-resistant steels have also made an outstanding record in such applications as furnaces, ovens, etc., where excessively high temperatures are applied?

Write us about your requirements

INGERSOLL STEEL DIVISION, Borg-Warner Corporation
310 South Michigan Avenue • Chicago 4, Illinois
Plants: Chicago, Illinois; New Castle, Indiana; Kalamazoo, Michigan

Look Inside
for Deming Pump Values!


Heavy Spring, keeping ball bearing always in tight contact with adjusting nut.
Deep Groove Ball Bearing, carrying radial and also thrust load.
Semi-enclosed Impeller, dynamically and statically balanced.
Adjusting Nut, controlling running clearance between the open side of impeller and casing.
Deep Groove Ball Bearing, free to move endwise.
Shaft of exceptionally large diameter ground to size.
Support Head is of unusually rigid design and is bored for both bearings at one setting. This insures perfect and permanent alignment.
The Bolted Type Stuffing Box facilitates the taking out of old packing and inserting new rings.

Deming Centrifugal Pump

Two Ball Bearing Type with Semi-enclosed Impeller
Figures 4003, 4013, 4023, and 4033

Note the features of this type of Deming Side Suction Centrifugal Pump in the sectional view above. Every detail is engineered to contribute to permanent alignment of operating parts. This assures trouble-free service over long periods of operation.

Ranging in size from 1 to 6 inch discharge, these pumps cover a wide scope of capacities from 10 to 1200 gallons per minute. They can be furnished for belt, electric motor or gasoline engine drive.

WRITE FOR BULLETIN 4013-A

This 16-page, 8½ x 11 bulletin contains complete information including Performance Tables on Deming Side Suction, Two Ball Bearing Centrifugal Pumps, Figures 4003, 4013, 4023 and 4033. *Write for a copy.*

THE DEMING COMPANY
525 BROADWAY • • SALEM, OHIO

DEMING
THE COMPLETE LINE
PUMPS AND WATER SYSTEMS

pared with £11,376,000 in the first half of 1947 and £13,613,000 in the whole of 1938. Given a further expansion of economic activity in general and chemical production in particular, these figures are bound to increase further.

In Britain's present currency difficulties it is very irksome that more than half of these imports are payable in dollars. The United States is leading in the British chemical import trade before Germany, and Canada and Chile are among other prominent suppliers. As British purchases from western Germany must be paid in dollars, the hard-currency expenditure for imported chemicals is now much higher than ever before.

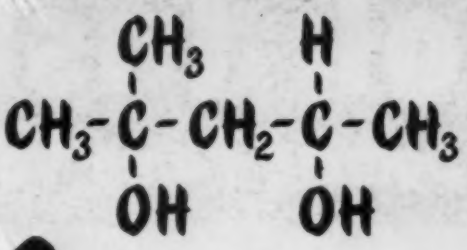
Currency Policies

Among policies considered to ease the currency problem three promise substantial relief in the long run: (1) Replacement of hard-currency supplies by purchases from soft-currency sources; (2) development of local productions to reduce imports generally; (3) extension of local processing facilities so as to import foreign commodities in their crudest and cheapest form. A fourth possibility, substitution of imported chemicals by locally available alternative products, has been tried but found to be impracticable in all but a few exceptional cases.

Special attention will no doubt be paid to the development of purchases from soft-currency countries. Sicilian sulphur, North African phosphates, French potash, Spanish pyrites, Norwegian carbide and Italian mercury could in theory meet all British needs of these commodities, but in practice an expansion of purchases in these countries has in the past been rendered difficult or impossible by lack of fuel and transport and the slow recovery rate in continental Europe. Schemes for the expansion of oilseed cultivation and metal production in Britain's African colonies have been retarded by the same factors and by the shortage of skilled labor. In general, however, it is believed that, under the stimulus of American economic assistance, the production of chemical materials in all these countries should increase appreciably in the next few years.

The development of local productions has been held up by shortages of plant, equipment and building materials, but considerable progress is anticipated in this field. It has just been announced that two new companies will erect plants for the production of carbon black on the Bristol Channel. Philblack Ltd. (formerly known as Palatinate Development Co.) will produce 25,000 short tons of Philblack

From SHELL CHEMICAL



Hexylene Glycol

A new plant at Houston, Texas has greatly increased the supply of this valuable solvent

PROPERTIES	
Molecular Weight	118.17
Specific Gravity 20°/4°C	0.9216
Boiling point (760 mm.)	198.27°C
Flash Pt., Cleveland Open Cup	230°F
Vapor Pressure at 20°C	0.02 mm. Hg
Refractive Index, n_D^{20}	1.4276
Viscosity at 20°C	41.7 centistokes
Weight (pounds per gal. at 20°C)	7.69

Among the many other Shell Chemical products are Tertiary Butyl Alcohol, Diacetone Alcohol, Allyl Alcohol, Diisobutylene and Acrolein

A data sheet and sample will be forwarded on letterhead request. Write your nearest Shell Chemical office.

HEXYLENE GLYCOL is a colorless, nearly odorless dihydric alcohol which is miscible with water and an unusually large number of dissimilar chemicals.

AS A COUPLING AGENT it offers distinct advantages in the formulation of *hydraulic brake fluids* because of its water tolerance, lack of rubber swell and compatibility with castor oil in all proportions. In addition, its chemical stability, viscosity index, lubricating properties and non-corrosiveness are equally satisfactory. HG is also widely used as a coupling agent and emulsion stabilizer in *engine cleaning compounds* and *"soluble" cutting oils.*

AS A SOLVENT its steep vapor pressure curve, good resin solvency and comparatively mild hygroscopicity make it particularly useful in the manufacture of "flash dry" and other types of *printing inks.*

AS A PENETRANT its mildly hygroscopic character, plus notable softening and coupling properties, suggest its use as a component of *yarn lubricants, mercerizing assistants and other textile chemicals.*

SHELL CHEMICAL CORPORATION

100 Bush Street, San Francisco 6 • 500 Fifth Avenue, New York 18

Los Angeles • Houston • St. Louis • Chicago • Cleveland • Boston • Detroit

"COOLIE" CONVEYING IS COSTLY

Yes, "coolie" conveying is costly because it takes so much manpower to reach modern production capacity levels. If you're using manpower in material handling — you're using a "coolie" system. Conveyors keep manpower on the production line! Investigate Standard Conveyors to handle pieces, parts, units, assemblies, cases, cartons, boxes, barrels, bales, bundles, packages — everything from mail to malleable iron castings! There's one to meet your needs in shop or warehouse. Standard Conveyor Co., General Offices: North St. Paul 9, Minn. Sales and Service in Principal Cities.

FREE HELPFUL LITERATURE
Send for Standard's Catalog. See how conveyors are used in every field of industry. Ask for Bulletin No. CM 11

Standard
GRAVITY & POWER
CONVEYORS

A and O at Avonmouth, and United Carbon Black Ltd. aims at an output of 12,500 short tons in a new factory at Swansea.

Barium chloride, at present available only from abroad, will soon be made by a firm in Yorkshire. Alginates are now being made on a growing scale from seaweed at Orasay on the Scottish island of South Uist. A new factory is being built by Lewis Berger & Sons for making styrene co-polymers. Nylon Spinners Ltd. have opened their big plant in South Wales. British Geon Ltd. have opened its polyvinyl chloride factory at Barry, South Wales. British Petroleum Chemicals Ltd. has made such good progress with the initial work that it will shortly raise its capital to £5,000,000 and begin with the erection of a large commercial plant.

New Basic Industries

Some of these developments are closely interlocked with the establishment of entirely new basic industries which will make it possible to start manufacturing activities from the crude raw material. Herring oil is now being extracted for the first time on commercial quantities from surplus herring at a factory at Wick, and another factory is being built for the Herring Industry Board at Greenock; for the time being, however, the oil will not be used for industrial purposes.

It may be hoped that these and other developments will help to lower the cost of chemical imports. The resulting saving in dollar expenditure was certainly one of the main considerations which caused the authorities to license the erection of new oil refineries, carbon black and petroleum chemicals plants, etc. It is in the field of organic chemicals that the biggest advances are expected. The smallest advance is likely to be observed in the electrochemical field although it offers similarly great opportunities for the replacement of imports. Here expansion is made impossible by the inadequacy of the present generating capacity; the new power stations scheduled to come into operation in the near future will only just be sufficient to meet the current needs of present consumers.

In the circumstances it is more than likely that British chemical imports will continue at a very high level. Savings in one field will be offset by larger requirements in others. A substitution of European supplies for materials now obtainable only from the western hemisphere should slowly help to overcome the dollar problem, but most observers in Britain believe that more immediate relief will be attained by grants

YOU GET
CORROSION RESISTANCE
AT A SAVING
with
CROLOY
7
the ECONOMY TUBING
Resists corrosive attacks from hot oils and oxidation up to 1250F much better than 5% Cr., .50% Mo tubing yet costs but little more.

THE BABCOCK & WILCOX TUBE COMPANY
General Offices: Beaver Falls, Pa. Plants: Beaver Falls, Pa. and Alliance, Ohio
Seamless and Welded Tubular Products in a full range of Carbon, Alloy, and Stainless Steels for All Pressure and Mechanical Applications.

Other B&W Products
THE BABCOCK & WILCOX CO.
85 LIBERTY STREET • NEW YORK 6, N. Y.

Stationary and Marine Boilers . . . Boiler Components . . . Pulverizers . . . Fuel Burning Equipment . . . Refractories . . . Chemical Recovery Units . . . Process Equipment . . . Alloy Castings

BABCOCK & WILCOX SEAMLESS & WELDED TUBES

TA-1478S

There's one formulation — and only one — that will keep your manufacturing or processing costs at a minimum. Let UBS *"Creative Chemistry"* lower your costs and increase production efficiency by recommending formulations tailored to your specific requirements.

Our technical staff will be glad to consider your problems without obligation.

Serving industry with
"creative chemistry"

Industrial Latex Adhesives
Rubber Solvent Cements
Synthetic Solvent Cements
Backing Compounds
Combining and Laminating Cements
Coating Compounds
Latex Concentrates
Tank Lining Compounds
Polystyrene Dispersions
Latex Extenders, Tackifiers

. . . Technical data sheets for each product available on request. *Write for yours today!*

UBS
UNION BAY STATE
Chemical Company Inc.
50 HARVARD STREET, CAMBRIDGE 42, MASS.

under the European Recovery Act. The first consignments of materials for chemical manufacture have already been received under this scheme, and while the Marshall aid is less important to the chemical industry than to other trades, its indirect repercussions are certainly expected to prove of great and lasting benefit.

Chrome Green Process Uses Chromic Anhydride

BELBOURNE—A process for chronic oxide green has been developed as an offshoot of a new Council for Scientific and Industrial Research process of producing chromic anhydride. The anhydride is heated under controlled conditions to cause the over-all decomposition

$$4CrO_3 \rightarrow 2Cr_2O_3 + 3O_2$$

There is no accumulation of by-product salts such as sodium sulphate or sodium carbonate as in the usual method. It is said that the properties of the product compare very favorably with the imported pigment and that it qualifies under the Australian Standard Specifications.

City Officials Inspect New Canadian Resin Plant

VANCOUVER—Members of the city council and board of trade at New Westminster, B. C., recently paid an inspection visit to the $400,000 automatic adhesive plant of the American Marietta Co. of Canada Ltd. at Sapperton, B. C., E. R. Dodd, manager, and his staff were hosts for the special tour.

The New Westminster plant is the most modern of its kind in Canada. It is a duplicate of the Seattle unit of the parent company but with a number of later improvements. Handling of chemicals is accomplished by push-button controls of valves and pumps.

The plant covers nearly one and a half acres with provision made for expansion to double or treble capacity. Main units of the factory include: four raw material tanks enclosed in an insulated and heated structure; the reactor building where the chemicals are mixed and heated in a huge kettle; boiler house; storage tanks for the finished product; and the warehouse and office building.

Production capacity of the factory is 1,000,000 lb. of synthetic resin a month. The raw materials, such as phenol and sodium hydroxide, are brought to the factory in tank cars and pumped into the storage tanks which have capacities of 10,000 to 20,000 gal. each.

Mr. Dodd revealed that virtually all

THESE FLANGES

Answer Important Questions About

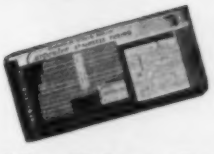
Which Stainless Tubing To Use...

Here is another example of the results you can get when you put Carpenter's experience with Stainless Tubing to work in your plant.

These Van Stone flanges were done cold, with the flanges rolled-out from the tube wall. Expansion is uniform throughout the flanged area. The corner at the back of each flange is sharp—with no weakening of the metal's structure.

When you are selecting Stainless Tubing and planning your fabrication jobs, it will pay you to make full use of Carpenter's experience. Want proof? Drop us a line, and we will work with your engineering staff.

SLIDE CHART DATA ON STAINLESS TUBING



This Carpenter Stainless Tubing Slide Chart provides information that has never before been available in such easy-to-use form. It contains data on Velocity Constants, Mass Velocity Constants, Areas of Tube, Physical Properties, etc. For your copy, just send us a note on your company letterhead.

THE CARPENTER STEEL COMPANY

Alloy Tube Division **• 105 Springfield Road, Union, N. J.**

Carpenter

STAINLESS TUBING

"MORE THAN CORROSION RESISTANCE"

MATERIAL HANDLING News

CLARK

a BIGGER exhibit of BETTER machines TO DO MORE WORK AT LOWER COST

—the Third National Materials Handling Exposition

The 1949 Exposition will be held in Philadelphia January 10 through 14 and will constitute a broad view and preview of "industrial history in the making." It will be the most convincing demonstration of all time that the Science of Materials Handling is eternally new—that it is a never-ending process of evolving new and better methods and equipment to the end that our National economy can shake off the shackles of old, inefficient and time-consuming practices which have become prohibitively costly both in human energy and in dollars.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY BATTLE CREEK 8, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

the heavy equipment had been manufactured in British Columbia. One of the tanks has a plastic lining, baked on in five coats. The piping and attachments are of stainless steel. Local plywoods are featured in the construction of the attractive warehouse and office building.

The company already has one tank truck on the road, while other shipments to the clients in the plywood and woodworking industries are made in tank cars or in drums.

A staff of 10 men runs the adhesive plant. Plant superintendent is H. E. Broe. G. A. Beckett is chief chemist.

India Plans Larger Plastics Plant Capacity

NEW DELHI—India has at present 75 presses engaged in compression molding, with an annual total capacity of about 1,000 long tons of powder, and six small injection presses, according to a survey by a government-appointed panel of plastics and celluloid industries.

Asserting that a plant using 100 long tons of molding powder annually is the minimum economic unit under Indian conditions the panel has proposed expansion of the industry to a point where it will consume 3,000 long tons annually for the next five years.

The panel recommends that import restrictions should be amended to allow purchase of American machinery, and adds that on the basis of prevailing American prices India needs capital goods for the plastics industry totalling more than $3,000,000 in the next five years.

Part of this would be spent on larger presses of up to 300 tons pressure, compared to the 100-ton units which are at present India's largest and which are obsolete.

Balance would be spent in establishing two die-making plants, each of which would be headed by an American die-maker.

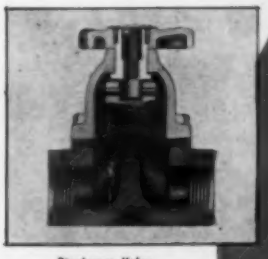
Production of the following molding powders is urged, as soon as basic chemicals required are available in India at economic prices: phenol-formaldehyde, urea-formaldehyde, cellulose acetate and cellulose nitrate.

Foreign News Briefs

R. W. Mayhew, newly appointed federal minister of fisheries in Canada, and first B. C. member to hold this portfolio, recently inspected the site of the proposed $150,000 biological station at Departure Bay near Nanaimo, B. C. He states that plans called for immediate commencement of work on this project.

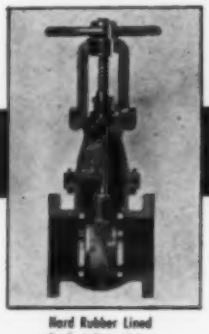
Hard Rubber Lined
Gate Valve
2" to 8"—150 psi.

Hard Rubber Lined
Cone Check Valve
1½" to 3"



Diaphragm Valve
(Hills-McCanna Co., Saunders Pat.)
Hard or Soft Rubber Lined, ½" to 6"
Ace Saran Body, ½" to 1¼"

ACE
HARD RUBBER and PLASTICS
STOP CORROSION AT ALL VITAL SPOTS



Hard Rubber Lined
Darling Gate Valve
2" to 24"—150 psi.

For instance . . . ACE VALVES for Every Need!

Ace hard rubber resists all alkalies, metallic salts of inorganic acids, nitric acid up to 16° Baume, phosphoric acid to 75%, sulphuric acid up to 50° Baume, most other inorganic acids any strength, and countless other corrosive solutions and fumes. Other Ace plastics such as Saran and Parian (polyethylene) extend this range of applications still further. Catalog 300-7 and Ace plastics bulletins tell you where Ace-clad and Ace molded equipment saves for you—send for them today.

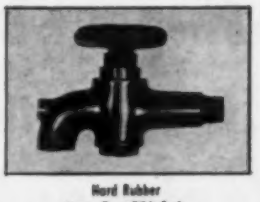
Hard Rubber Lined
Foot and Check Valves,
Horizontal, Vertical,
and Angle

Hard Rubber Lined
Paul Valve
2" to 6"—150 psi.

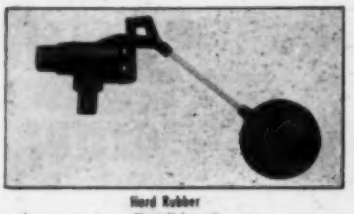
Hard Rubber Lined
Darling Check Valve
2" to 24"—175 psi.

Hard Rubber Screw Type
Straightway Cock
½" to 2"—50 psi.

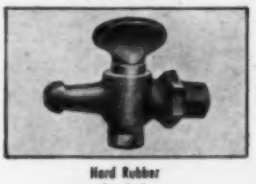
Hard Rubber
Globe Angle Valve
1½"—50 psi.



Hard Rubber
Screw Type Bibb Cock
⅜" to 1"—50 psi.

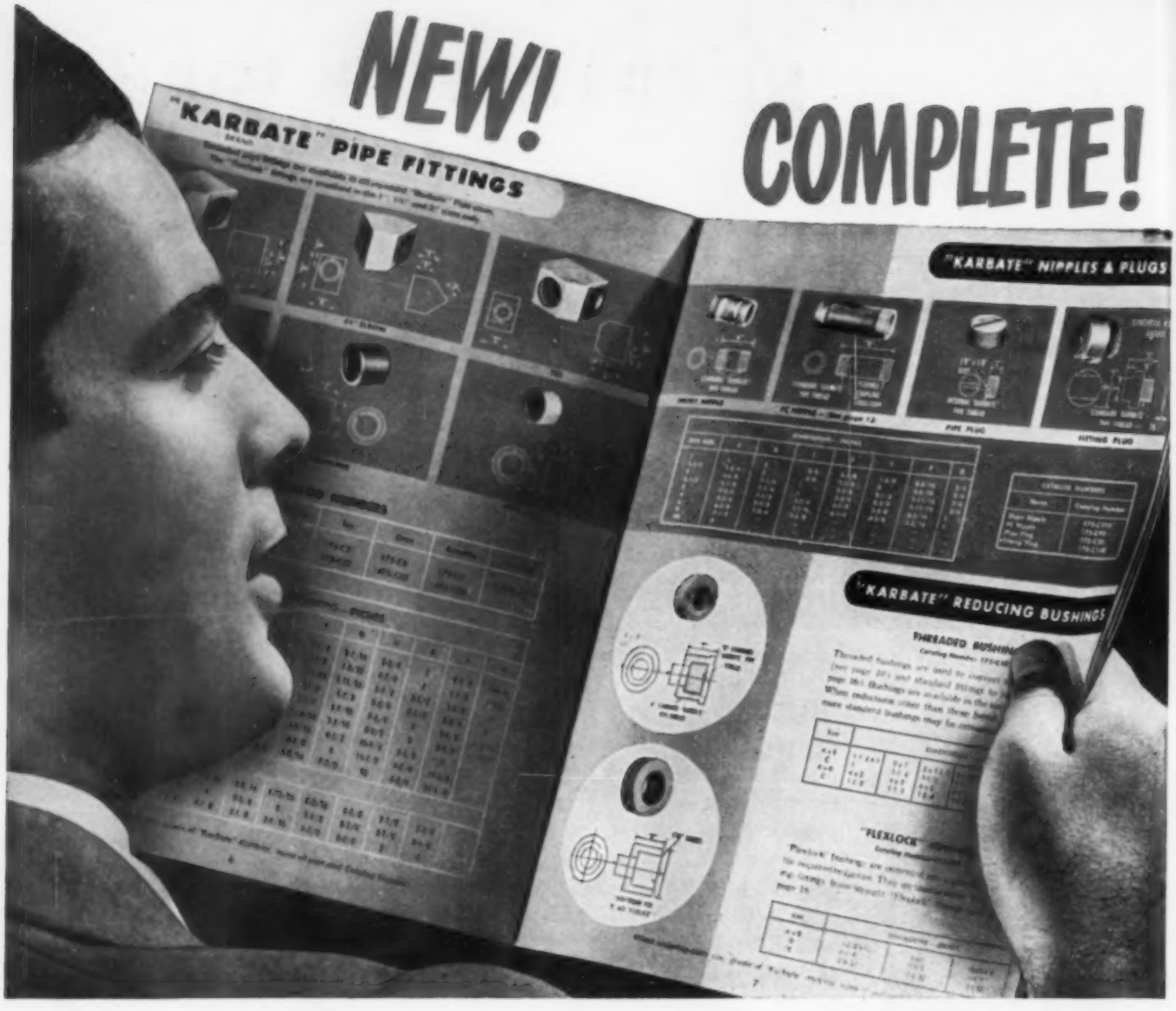


Hard Rubber
Float Valve
½" to 1½"—50 psi



Hard Rubber
Pet Cock
¼" to ⅜"—50 psi.

Hard Rubber
Screw Type Plug Cock
¼" to 4"—50 psi.



Get this 16-page booklet on how to select... order...and install "Karbate" Impervious Graphite pipe and fittings!

Here are all the details you need to plan and order "Karbate" pipe and fittings which will stand up under the corrosive action of acids, alkalis, and other chemicals . . . regardless of the size or complexity of your plant. The booklet tells you:

- **How to select** the proper grade of "Karbate" Impervious Graphite or "Karbate" Impervious Carbon equipment to handle acids, alkalis, salts, halides, organic compounds, or mixtures presenting corrosion problems.
- **How to order** "Karbate" brand pipe and fittings directly from the complete tables fully covering sizes, grades, and designs.
- **How to install** "Karbate" pipe and fittings, including instructions on machining, cementing, serrating, threading, and coupling.

This booklet is complete. It is practical. It is usable. Write for catalog section M-8800B, to National Carbon Company, Inc., Dept. CE.

The term "Karbate" is a registered trade-mark of
NATIONAL CARBON COMPANY, INC.
Unit of
Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York 17, N.Y.

Division Sales Offices:
Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

These products sold in Canada by Canadian National Carbon Co. Ltd., Toronto 4, Canada

Nitric Acid Containers

MCA finds best materials are stainless Types 304 and 347 and aluminums 3S and 99.6 percent.

WHAT are the most suitable materials from which to make shipping and storage drums to contain strong nitric acid? To find out, the Manufacturing Chemists' Association, through its Metal Packages Committee, sponsored a cooperative testing program. Test findings have been summarized in a report. Participating in the cooperative program were Aluminum Co. of America, General Chemical Co., Hercules Powder Co., Monsanto Chemical Co. and Union Carbide & Carbon Research Laboratories, Inc.

The Union Carbide & Carbon Research Laboratories prepared the stainless steel specimens, carried out the various heat treatments, made the chemical analyses and ran the qualification tests in 65 percent boiling nitric acid. The aluminum specimens were prepared, heat-treated and analyzed by the Aluminum Co. of America. The other companies, and the Aluminum Co. of America also, made the strong nitric acid tests.

Each of four participating companies ran corrosion tests on six grades of stainless steel and two grades of aluminum. The test specimens were exposed to the liquid and vapor phases of 93 and 95 percent nitric acid or 97 and 99 percent nitric acid under slight pressure at a constant temperature of 130 deg. F. for three 30-day periods. The specimens tested represented the various conditions of fabrication and heat treatment encountered in the manufacture of drums. Stainless steel specimens, for example, were flash- and chime-welded. Aluminum specimens were seam-welded and cold-worked chime sections. Tests were run on specimens of steel and aluminum in both the as-fabricated and heat-treated conditions. After each 30-day test period, the specimens were washed, dried and weighed, and the corrosion rates calculated in inches penetration per month using this formula:

$$R = 43.9W/AsT$$

where R is the corrosion rate in inches per month, 43.9 a conversion factor, W the weight loss in grams, A the total area in square inches, s the density in grams per cubic centimeter and T the time in hours.

In addition, all specimens were subjected to five 48-hr. periods in the standard 65 percent boiling nitric acid test. This was done to determine: (1) effect of cold working; (2) effect of heat from welding; (3) effect of heat treatment; and (4) quality of stainless steel welds and parent metal. The 65 percent boiling nitric acid test is a mandatory requirement of the Interstate Commerce Commission's regulations for materials that are to be used in the construction of 5C shipping containers.

Unfavorable results were obtained with Type 304 (18-8 stainless steel) exposed to 97 and 99 percent concentrations of nitric acid at 130 deg. F. This did not agree with the actual experience of some of the participants who have been successfully shipping 97 and 99 percent nitric acid for years in Type 304 stainless steel drums. So further tests were initiated to evaluate the effect of temperature and to correlate corrosion results with actual drum tests.

Corrosion tests were run again on welded specimens of the Type 304 stainless steel and on two grades of aluminum as well. Tests were run for three 30-day periods, with specimens exposed to liquid and vapor phases of 93, 95, 97 and 99 percent nitric acid. This time temperatures were 90 and 110 deg. F. These temperatures more nearly approach actual transportation and storage conditions. Moreover, the added data thus obtained helped in determining the effect of temperature on acceleration of corrosion.

In addition, two drums made of Type 347 (18-8 with Cb) were filled, one with 93 percent and the other with 99 percent nitric acid, and exposed to the direct rays of the sun at the Parlin, N. J., plant of Hercules Powder Co. for a period of three months. The drums were placed on their sides and were filled to within three inches of the top. Fittings were placed on the drums so that the acid temperature and pressure inside the drum could be recorded. Readings were taken daily both in the morning and afternoon for a period of 90 days. Thus the average daily temperatures and pressures attained were determined, as well as the effect of strong acid after relatively long periods of exposure. Aluminum drums were not available because of war shortages, therefore, comparable weather tests were not made.

For drums and storage containers to contain 93 and 95 percent nitric acid, all grades of stainless steel and aluminum tested may be used as construction materials. The six grades of steel tested were: (1) 26 Cr; (2) 17 Cr; (3) 19 Cr, 9 Ni (the 18-8 stainless); (4) 19 Cr, 11 Ni, 1 Cb (the columbium-bearing grade); (5) 25 Cr, 14 Ni; and (6) 25 Cr, 18 Ni. The two grades of aluminum tested were the 99.6 Al and the 3S. The stainless steel must be properly heat-treated or else it must contain the stabilizing agent columbium, as the austenitic Cr-Ni grades do, to maintain maximum corrosion resistance. Heat treatment is not essential for aluminum. Both aluminum and stainless steel appear to have equal corrosion resistance in these concentrations of acid.

For drums or storage containers handling 97 and 99 percent nitric acid, the following construction materials may be used: properly heat-treated 18-8 stainless steel (Type 304); columbium-bearing Type 347 stainless,

This article is based upon a report, dated Oct. 23, 1947, which summarizes the findings of a cooperative testing program sponsored by the Drum Committee of the Manufacturing Chemists' Association. George A Sands, who is with the Electro Metallurgical Co., a division of Union Carbide & Carbon Corp., was subcommittee chairman.

Match your Painting Problems against these SOLVED by Prufcoat*

Corrosion Case History #325

Corrosion Case History #326

Corrosion Case History #327

Corrosion Case History #328

Sulfuric Acid Concentration Plant, troubled with costly corrosion, applied Prufcoat protective coatings and reports: ***"Prufcoat on floors and pump supports — good after two years of service."***

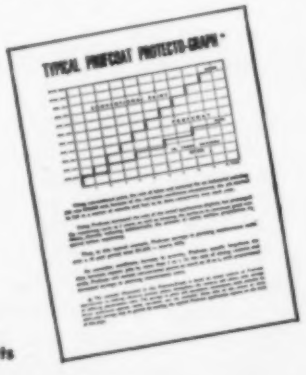
Muriatic Acid Fumes were eating concrete in a well-known acid plant. After repeated failures, Prufcoat was tried. 6 years later their job report reads: "Painted concrete piers and beams that were subjected to muriatic acid fumes with Prufcoat and to date have ***noticed no further deterioration of the concrete."***

Plating Room Fumes are death to ordinary coatings. So this large plating plant tried Prufcoat on various surfaces subject to corrosion. Their report: "Only coating found to withstand action of hot plate solutions and ***remain in good condition for two years."***

50% Caustic Soda Solutions are carried in tank cars owned by this large plant. After repeated coating failures, Prufcoat was applied. Result: "Prufcoat . . . ***unaffected by spills and drips after two years continuous service."***

Yes, in plant after plant Prufcoat is solving tough maintenance painting jobs involving corrosion from acids, alkalies, oil and water. Try this performance-proved protective coating yourself. Apply Prufcoat on machinery, equipment, pipes, walls, floors — ***any metal, masonry or wood surface.*** See how it ***stops corrosion cold, saves your equipment, cuts painting maintenance costs.***

****Taken from actual reports on file at Prufcoat Laboratories, Inc.***



You, too, can save . . . Write for proof!

Yes, the Protecto-Graph plan proves—*with your own figures* — that you can cut costly corrosion, save painting maintenance costs in your plant. Write for your copy *today.*

PRUFCOAT LABORATORIES, INC.
63 Main Street • Cambridge 42, Massachusetts

Seven attractive colors that apply like paint to metal, masonry or wood

SAVES MORE BECAUSE IT PROTECTS MORE

not heat-treated; and aluminum grades 99.6 and 2S. For stainless steel, heat treatment after fabrication is required unless the stabilized grade containing columbium is used. The corrosion resistance of aluminum in these concentrations of acid is much superior to that of Types 304 and 347 stainless steel. Drums made from these grades of stainless steel are entirely safe for transportation and storage of 97 and 99 percent nitric acid, but their utility will depend upon the severity of storage conditions and the quality of acid required. Since various sources report successful use of Types 304 and 347 stainless steel for drums to contain 97 to 101 percent nitric acid, it would appear that the conditions of the MCA cooperative testing program were much more severe than those encountered in actual practice.

Correction

CONSTRUCTION MATERIALS FOR JET PUMPS
Chemical Engineering, September 1948

A NUMBER of serious mistakes appeared in the second spread of this article, pages 116 and 117.

(1) In the line of small type above the table, change "0.250 deg." to "0-250 deg."

(2) In the table, changes in ratings should be made as follows: Acidseal E and Saniprene under Carbonic acid should be *E,* not blank; Karbate under Stearic acid should be *E,* not *P;* Stoneware under Sulphuric acid should be *E,* not *PE.*

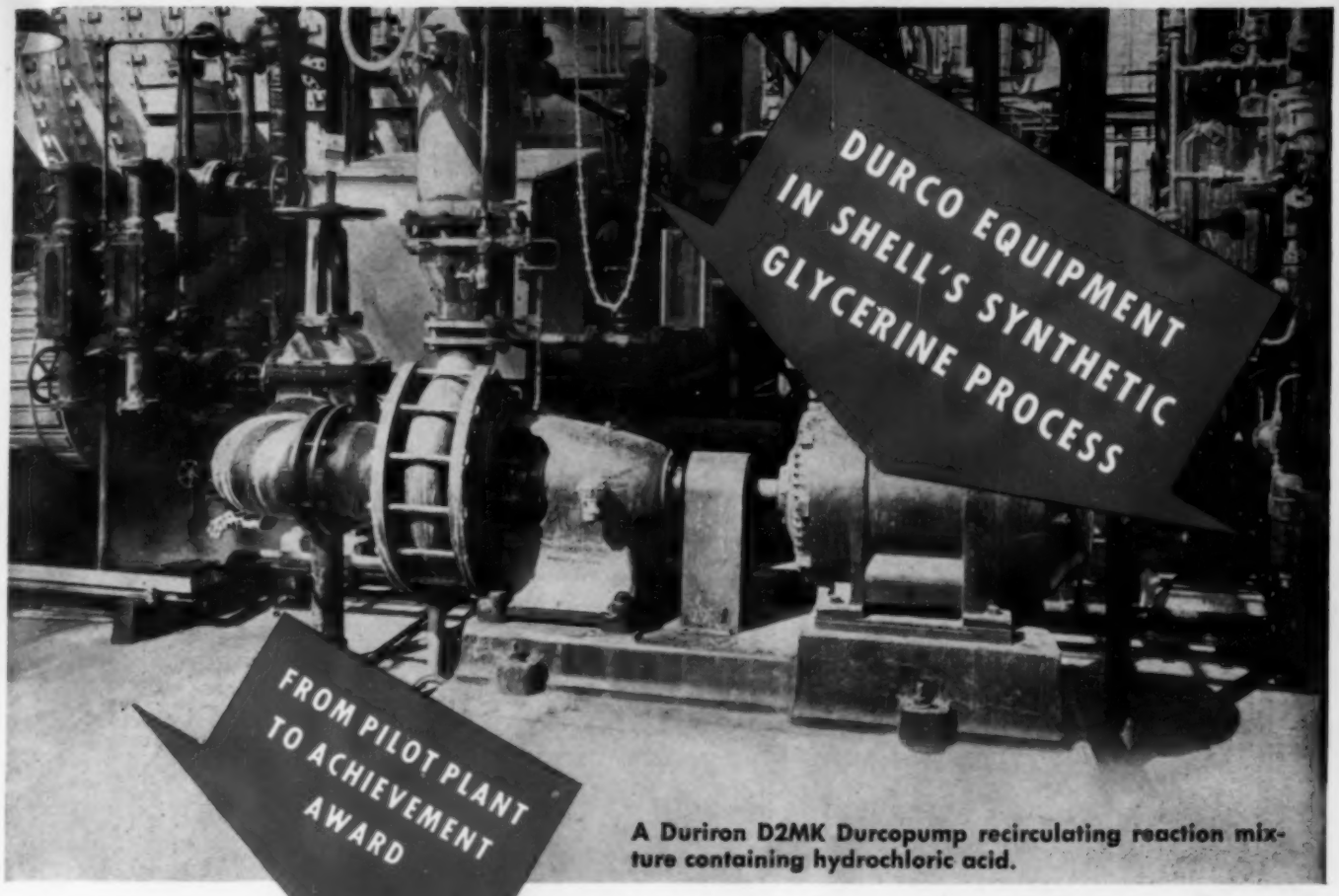
(3) Certain of the limitations set forth in the footnotes should have been displayed more conspicuously. The limitations in question are as follows: Ratings for Acidseal E, Saniprene and Triflex are for static conditions and to 150 deg. F. only. Ratings for Hard rubber are for compressed air jets only. Ratings for Pyrex 7740 are for static conditions only. Ratings for Porcelain are for comparatively static conditions only.

(4) Add the following to the footnotes:
Hard rubber type linings such as the Acidseal E or the Saniprene are recommended for withstanding the effects of vapors and of dilute concentrations, say up to 5 percent. However, for certain services, and where some chance for abrasion (not erosion or cavitation) exists, it is felt that Triflex would prove more satisfactory.
With regard to phosphor bronze, it would be expected that the corrosion rates will increase with increasing temperature of operation of the pump. In general the corrosion resistance of the several bronzes (5, 8, and 10 percent phosphor bronze and free-cutting phosphor bronze) may be considered to increase as the tin content increases, but all four alloys will have the same order of corrosion resistance.

(5) Type lines in the first five columns of this spread, that is, the five short columns under the table, were badly jumbled. They are reprinted below in correct arrangement:

Column One.....

is therefore one of the critical conditions to be met, since erosion results almost entirely from the supersonic velocities of the jet. This condition may be considerably aggravated if



A Duriron D2MK Durcopump recirculating reaction mixture containing hydrochloric acid.

Durco equipment went into the first pilot plant built by Shell 12 years ago, and was used continuously through their research work. It played an essential part in the commercial plant just opened.

Durco equipment is equally ideal for *your* pilot plant and full scale operation.

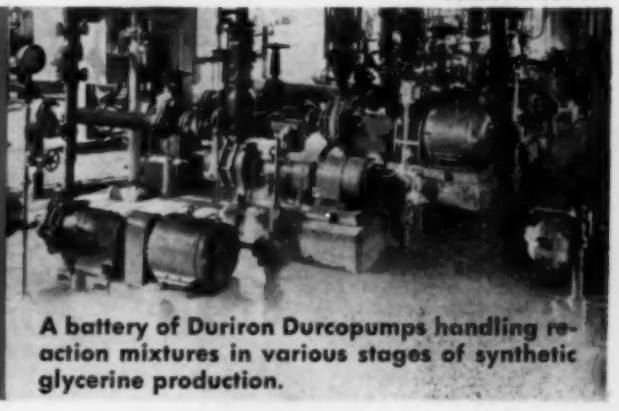
- Interchangeability of pump parts allows for proving what alloy is best for a new process without the purchase of many different pumps.
- Plug valves in different alloys provide another means of determining best alloy construction.
- When commercial plant is built Durco equipment is available in the alloys and sizes required.

DURCO ADV. 81-GM

Write for Catalog K. It covers 36 items made in corrosion resisting alloys. For information on Durcopumps, ask for Bulletin 815.

DURCO
CORROSION-RESISTING ALLOYS & EQUIPMENT

THE DURIRON CO., INC.
DAYTON 1, OHIO
Branch Offices in Principal Cities



A battery of Duriron Durcopumps handling reaction mixtures in various stages of synthetic glycerine production.

In the Glare of the Torch— think of WILLSON

Style CW60

ROOM WANTED FOR SPECTACLES? . . . There's comfort for wearers of prescription glasses in Willson Cover-Alls.* And the adjustable leather bridge rests lightly on the nose without pressure. Willson-Weld* lenses in the shade you specify, of course.

Style RW50

GAS WELDERS GO FOR IT . . . Assured protection of Willson-Weld lenses and comfortable face fit make this goggle day-in, day-out favorite for flame cutting and cleaning as well as welding. Indirect ventilating ports exclude glare.

Style DC50

FOR EYES THAT LEAD A DOUBLE LIFE . . . From welding to chipping with a flip of the wrist! Willson-Weld lenses in separate frames flip up to leave eyes protected by clear, Super-Tough* lenses.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest Willson distributor or write us direct.

*Reg. U. S. Pat. Off.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON PRODUCTS INCORPORATED

Established 1870

223 WASHINGTON ST. • READING, PA.

the motive steam is not entirely dry. The cutting power of a jet of wet steam is sufficient to bore through a steel plate placed between the nozzle and the diffuser.

Resistance to Corrosion—Even in minute quantities, corrosive liquids or gases in jet streams are highly

Column Two

destructive, and many chemicals, such as chlorine, caustic soda, or hydrochloric acid, when in combination with wet steam gain even more corrosive effect. Jet parts may be exposed to almost any corrosive chemical in its combination with steam. New materials of construction are constantly being evolved, and recent improvements enable jet pumps to last months or years instead of days.

Machinability—Ready machinability is necessary to meet the precise

Column Three

designs required for efficient operation. The manufacture of diffusers is largely empirical, for fundamental information is comparatively unavailable on reactions of streams at supersonic velocities. Manufacturers have evolved diffuser designs and assembly relationships, however, which can be balanced efficiently if the construction materials are machinable to close tolerances.

Maintenance to Close Tolerances in Replacement Parts—Jet parts will eventually need replacement, and

Column Four

since the efficiency of the original unit was achieved by balancing parts at close tolerances in the fabricator's test laboratory, the replacement parts must match the original tolerances very closely if this interbalance and efficiency is to be maintained. Otherwise the entire unit will have to be shipped back to the fabricator for rebalancing—an expense and inconvenience to the user. Materials which do not lend themselves readily to reproduction in precise tolerances,

Column Five

such as molded parts that shrink from mandrels in setting, therefore are disadvantages as jet pump materials.

Survey of Materials

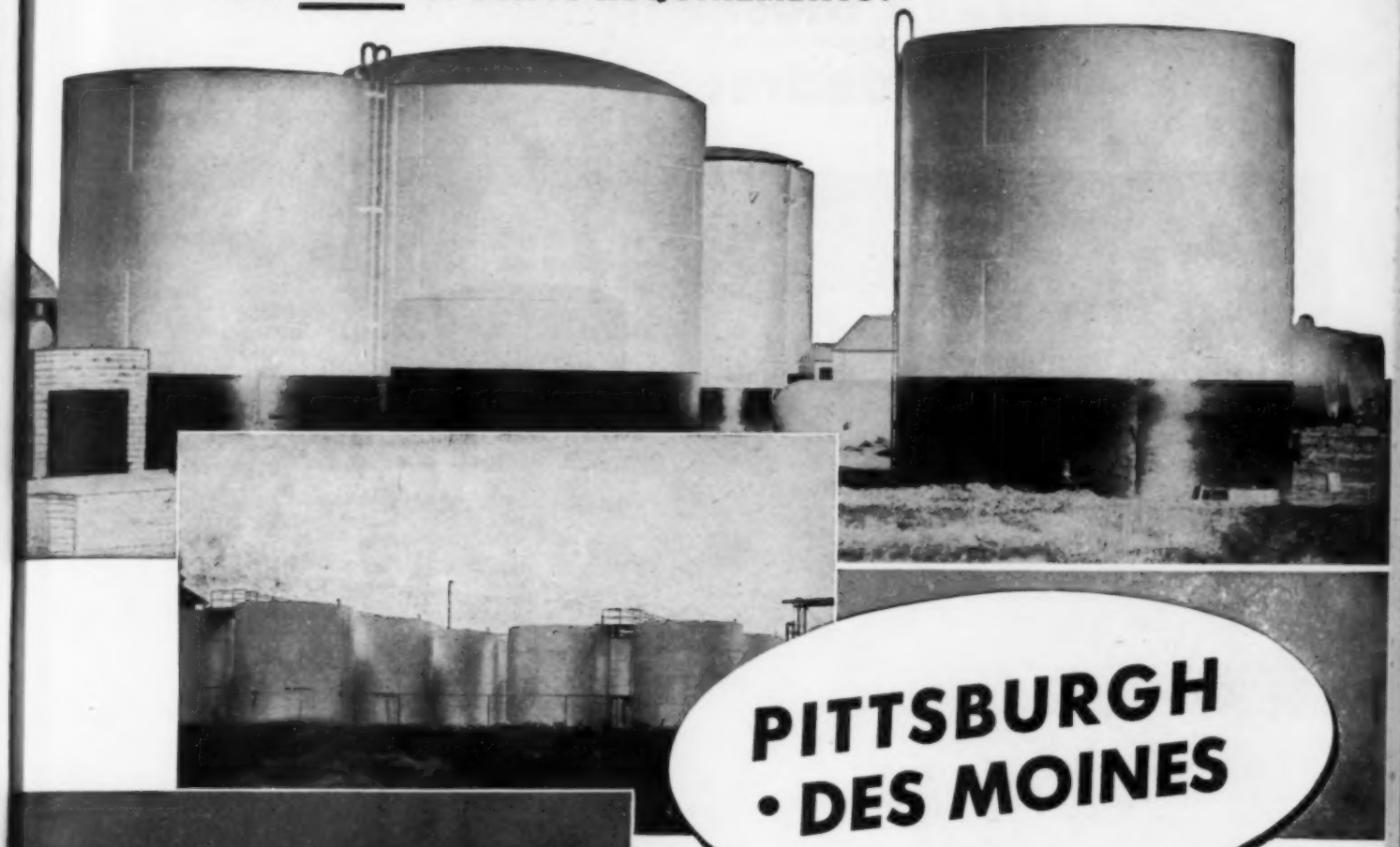
A survey of ejector manufacturing member companies of the Heat Exchange Institute has been made by the author. It reveals that materials of construction for corrosive conditions of service are limited chiefly to six nonmetallic and eight metallic

Column Six (No Change)

types of material. These are Karbate impervious graphite, glass, porcelain, Haveg, hard rubber, stoneware, stainless steels 304 and 316, bronze, monel, high-silicon iron, chrome plated cast iron, Hastelloy alloys (A,B,C) and lead. . .

Adaptable, Low-Cost Liquid Storage

FOR YOUR SPECIFIC REQUIREMENTS!



PITTSBURGH • DES MOINES

STEEL STORAGE TANKS

Wherever liquids of any type are to be stored at atmospheric pressure, you'll find utmost economy and long-lived dependability in Steel Storage Tanks by Pittsburgh-Des Moines. Experienced design, careful craftsmanship in fabrication and erection, and a definite guarantee of satisfaction join to make the best of reasons for specifying "Pittsburgh-Des Moines." *May we quote on your storage needs?*

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH . . . . . 3417 Neville Island
DES MOINES . . 916 Tuttle Street
NEW YORK . . . . Room 990, 270 Broadway
DALLAS, 1216 Praetorian Building
CHICAGO, 1207 First National Bank Building
SEATTLE, 507 First Avenue, South
SANTA CLARA, CAL. . . . . 606 Alviso Road

DICALITE Mineral Fillers

prove most efficient material in hundreds of industrial uses.

Applications given very briefly below are examples of how Dicalite Mineral Fillers improve product quality, simplify processing, increase production and reduce costs.

ASPHALT PRODUCTS	Dicalite raises the softening point, reduces brittleness, and generally increases durability and weathering qualities of roofing coatings and many other compositions.
CATALYTIC PROCESSES	Its tremendous surface area, absorptiveness, light weight, etc., make Dicalite an efficient carrier for catalysts.
CLEANSERS & POLISHES	The diatom structure of Dicalite enhances scouring action, and its high bulking effect adds considerable volume at low cost.
EXPLOSIVES	Efficient absorbent and anti-caking agent for nitro-glycerin and other explosive ingredients, and for pyrotechnic compositions.
FERTILIZERS	Anti-caking properties are of high value in ammonium nitrate and other fertilizers.
INSECTICIDES	Great surface area, high absorption and light weight of Dicalite improve dusting and spraying qualities and insure maximum coverage when used as a carrier or diluent.
PAPER	Dicalite is used in paper and paperboard products to improve sheet formation, speed up drying, increase production; also for pitch and asphalt control.
PAINT, VARNISH, ETC.	Inert flatting agent and extender for all types of paints and paint products. Flats most effectively, improves brushing and leveling, increases durability.

These are typical of many industrial uses. Full information on how Dicalite may be able to improve production and reduce costs in your plant will be sent on request to our nearest office.

DICALITE Mineral Fillers are produced from diatomaceous silica, a material deposited several million years ago on the bottoms of oceans and lakes. They are composed of the siliceous remains or "skeletons" of minute aquatic plants called diatoms.

Chemically, the finished materials are practically pure silica (SiO_2) and inert. They are amorphous in character (not crystalline), comparatively soft and friable, and free from gritty matter. Following data give the range of properties of the many grades of Dicalite available for filler use.

Colors .....gray white, buff, white
Particle Size.....from all through 150 to trace on 325 mesh screen
Weight (loose).....8 to 13 lbs. cu. ft.
Surface Area..20,000 to 100,000 sq. ft. per lb.
Porosity .....approximately 90%
Melting Point .....approximately 2900° Fahr.

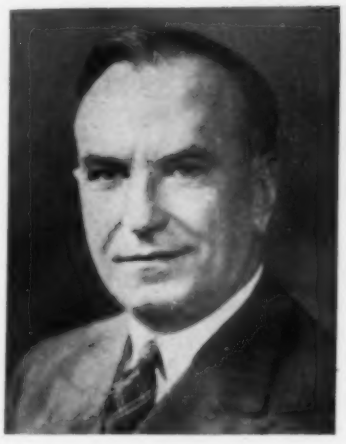
THE DICALITE COMPANY

DIV., GREAT LAKES CARBON CORPORATION — CHICAGO 11 • NEW YORK 17 • LOS ANGELES 14

DICALITE MINERAL FILLERS

NAMES IN THE NEWS

Man of the Month



J. A. Rafferty

James A. Rafferty, vice president of the Union Carbide and Carbon Corp., has been awarded the Chemical Industry Medal for 1948 for his leadership in developing the billion-dollar synthetic aliphatic industry. The medal, conferred annually by the American Section of the Society of Chemical Industry for outstanding contributions to the advance of chemical industry, was given to Mr. Rafferty at a dinner meeting in the Waldorf-Astoria on November 5.

During the war, Mr. Rafferty, who is chairman of the board of the Carbide and Carbon Chemicals Corp. and a senior officer of several other Carbide affiliates, was executive officer in charge of the extensive operations of Union Carbide in connection with the government's synthetic rubber and atomic energy projects.

Mr. Rafferty was born in Chicago May 4, 1886; went to Chicago schools; studied engineering and chemistry at Lewis Institute of Technology. Following graduation in 1908, he was employed by the Peoples Gas, Light, and Coke Co. of Chicago. In 1917 he left to join the Linde Air Products Co. which later that year became a unit of Union Carbide and Carbon Corp. When Carbide and Carbon Chemicals Corp. was formed in 1920 he was made general manager; vice president in 1924; president in 1929; chairman of the board in 1944.

He is a member of the American Chemical Society and the Chemists Club; lives in Rye, N. Y.

Osborne Bezanson and **R. R. Cole**, vice presidents of Monsanto Chemical Co., St. Louis, Mo., have been made members of the executive committee in a recent move that increased the number of members to five. Bezanson was formerly general manager of the organic chemicals division and Cole was formerly general manager of the company's phosphate division. Mr. Bezanson will be succeeded by **W. G. Krummrich**, assistant general manager of the division, who will serve as acting general manager. **John Christian**, manager of the company's plant at Monsanto, Tenn., will replace Mr. Cole as acting general manager of the phosphate division.

Carroll A. Hochwalt, vice president in charge of the Monsanto Chemical Co.'s central research department at Dayton, Ohio, has been named coordinator of the company's research and development activities. Dr. Hochwalt will be succeeded as head of the central research department by the associate director, **Howard K. Nason**, who will serve as acting director.

Fred G. Gronemeyer has been named to the newly created post of chief engineer of the Monsanto Chemical Co.'s organic chemicals division. Mr. Gronemeyer, who has been director of general engineering, will continue to be in charge of that department until a successor has been appointed.

Blythe M. Reynolds was elected vice president of Merck & Co., Inc., in charge of engineering and research at the directors' meeting October 27.

Russell F. Hazelton has been appointed associate professor of chemical engineering at North Carolina State College, Raleigh.

Ira J. Friedman, who recently received a master's degree in chemical engineering from Columbia University, has joined the research and development staff of Chas. Pfizer & Co.

R. Carboni, who recently received his master's degree in chemistry from Columbia University, has joined the research staff of Chas. Pfizer & Co.

Robert Lee Moore has been elected chairman of the new section of the American Chemical Society at Richland, Wash. The section has a charter enrollment of 102 members and all are associated with the Hanford Engineer Works.

R. L. Moore

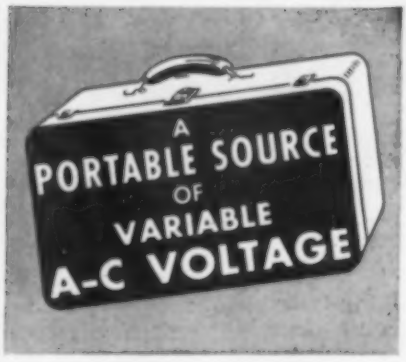
R. Coleman

Russell Coleman, director of the Mississippi Agricultural Experiment Station, has been named president of The National Fertilizer Association. He will succeed **Maurice H. Lockwood** who recently resigned.

Frank H. Griffin, vice president of the American Viscose Corp., has been elected a member of the board of trustees of Drexel Institute of Technology.

Robert A. Stauffer has been appointed assistant director of research of National Research Corp., Cambridge, Mass. **James H. Moore** has been promoted to director of the metals department succeeding Mr. Stauffer.

Fred C. Goodwill has been appointed resident manager of the Kalamazoo mill of the St. Regis Paper Co. **John H. Heuer** will succeed Mr. Goodwill as technical director of the central laboratory of the company at Deferiet, N. Y. **Peter J. Massey**, resident manager of the company's Kalamazoo mill,



VOLTBOX
A-C POWER SUPPLY

- *COMPACT*
- *PORTABLE*
- *HANDY*

Operation of the Superior Electric VOLTBOX is simple. Plug into 50/60 cycle single phase source, snap "ON-OFF" switch to "ON". Snap "LINE-LOAD" switch to "LOAD", rotate knob to produce continuously adjustable output voltage, from 0 to 17 per cent above line voltage. Read line voltage by snapping "LINE-LOAD" switch to "LINE".

TYPE UC1M

INPUT:	115 volts, 50/60 cycle, single phase
OUTPUT:	0-135 volts, 7.5 amperes, 1000 VA

Type UC2M available for 230 volt operation.

ALL THIS IN ONE PORTABLE PACKAGE

Cast aluminum case • POWERSTAT variable transformer • Easy-to-read voltmeter • Superior 5-Way Binding Posts • Output receptacles • "ON-OFF" switch • "LINE-LOAD" switch • Renewable fuse for overload protection • Six foot cord-plug.

FOR FULL DETAILS WRITE

THE
SUPERIOR ELECTRIC
COMPANY
211 LAUREL STREET
BRISTOL, CONN.

has been appointed chairman of the company's new products development committee and will have his headquarters in New York.

Ronald B. Smith has joined the engineering staff of the M. W. Kellogg Co.

George W. Oakes has resigned as superintendent of Pittsburgh Plate Glass Co.'s plant at Crystal City, Mo. **Robert M. Conley**, assistant plant superintendent since 1939, has been named superintendent and **B. H. Greenop** has been appointed assistant superintendent.

Irving Waltcher has been appointed research associate at the New York State College of Forestry at Syracuse University. Both natural-fiber and synthetic-fiber wood plastics will be the subjects of Dr. Waltcher's research.

Donald K. Morgan has been appointed as chief engineer of John I. Thompson & Co. succeeding **Charles J. Roggi**, resigned.

J. R. Moore has been elected president of the Harwick Standard Chemical Co., Cleveland, succeeding the late **Curtis J. Harwick.**

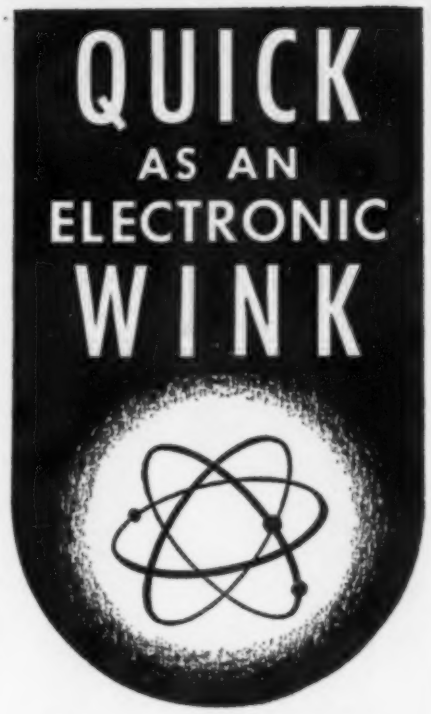
J. C. McKenna, product manager of chromium chemical sales for Diamond Alkali Co., has been named product manager of alkali sales, succeeding **J. D. Mattern**, who is retiring. **Charles T. Grant**, assistant to the president of Martin Dennis Co. of Newark, N. J., will succeed McKenna.

Walter L. Sheppard, Jr., has severed his connection with Atlas Mineral Products Co. and sailed to England to accept employment as technical advisor to Tanks & Linings, Ltd., Worcestershire.

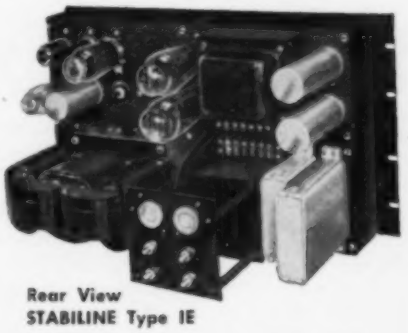
Elliott W. Amon has joined the research staff of A. E. Staley Manufacturing Co., Decatur, Ill., as a junior research chemist.

Claude E. Swift has been elected vice president in charge of research and patents by Union Oil Co. of Calif., Los Angeles. Swift joined Union in 1926 as senior inspector in the research department. He was appointed manager of research and patent counsel in 1947.

Nels E. Sylvander, formerly research engineer with the Engineering Research Institute, University of Michigan, is now associated with the Pittsburgh Consolidation Coal Co., research and development division at



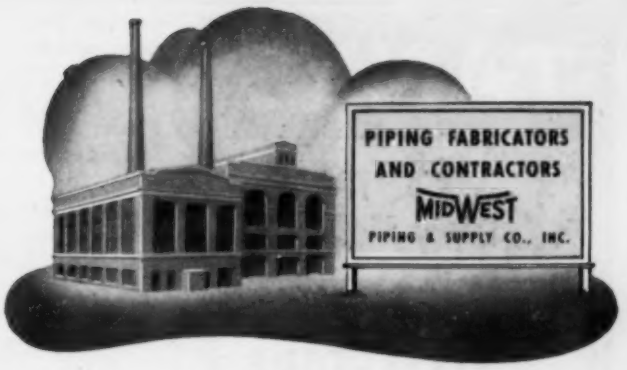
That's how fast a STABILINE Automatic Voltage Regulator corrects line voltage fluctuations. Type IE (Instantaneous Electronic) has no moving parts — is completely electronic in operation. Designed to act instantaneously—with a waveform distortion not exceeding 3 percent — and to keep output voltages stable within ±0.1 of 1 percent of the preset value, regardless of line variations. For any load current change or load power factor change from lagging .5 to leading .9, the STABILINE Type IE will hold the output to within ±0.15 volts of nominal. Various models available in numerous ratings.



Rear View
STABILINE Type IE

Bulletin 547 gives you information on this and other Superior Electric voltage control equipment. Write for your copy today.

THE
SUPERIOR ELECTRIC
COMPANY
211 MEADOW STREET
BRISTOL, CONN.



FIRST-HAND EXPERIENCE IN THE FIELD

Helps Maintain the HIGH QUALITY of

MIDWEST

PRE-FABRICATED PIPING

Midwest not only has a pipe fabricating organization of exceptional skill . . . it also has a Construction Department which has been erecting all kinds of piping for 48 years.

As a result, our shops get continuous first-hand field reports on the erection of fabricated piping. Our Construction Department constantly keeps us mindful of the importance of accurate alignment, thorough cleaning, careful inspection and testing of all bends, welded subassemblies, etc., before they leave the shops.

This situation has been of immense value in maintaining the high quality of Midwest Piping. The Construction Department also is the source of countless suggestions for improvement in pressure piping. All Midwest customers benefit from the accumulation of these suggestions.

Midwest, with four fabricating plants strategically located, has nationwide experience in satisfying the piping needs of all industries. You will always find it advantageous to use Midwest Pre-Fabricated Piping . . . either when purchased on the basis of materials only or piping completely installed.

MIDWEST PIPING & SUPPLY CO., INC.
MAIN OFFICE: 1450 SOUTH SECOND ST., ST. LOUIS 4, MO.

Plants: St. Louis, Passaic, Los Angeles and South Boston • Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. Tulsa 3—533 Mayo Bldg. • South Boston 27—427 First St.

PIPING FABRICATORS AND CONTRACTORS

3480

TANKS

Every Type
Every Metal

★

Made to Order
by **LITTLEFORD**

Here is an organization that meets every requirement in workmanship, materials and lasting qualities. Our engineers will design what you require, or we will fabricate to your own specifications. Whatever the type, you can get it at Littleford: plain tanks, jacketed, pressure, mixing or storage. And we work in all the accepted metals—stainless steel, Monel, nickel, Inconel, aluminum, etc. For tailor-made tanks to meet your exact situation, consult with Littleford engineers.

FABRICATORS OF PLATE AND SHEET METALS

LITTLEFORD

LITTLEFORD BROS., INC.
428 E. Pearl St., Cincinnati 2, Ohio

Library, Pa., as the coordinating engineer on coal gasification development work.

Frederick Bellinger, professor of chemical engineering at Georgia Institute of Technology, has gone to Germany at the invitation of Gen. Clay to make a specific survey of the German chemical industry. The results will be utilized by the American and British Military Governments in their industrial plans for the country.

Thomas J. Hargrave has resigned as chairman of the munitions board. President Truman appointed **Donald F. Carpenter** of Southport, Conn., as his successor.

John B. Calkin, coordinator of research for Union Bag & Paper Corp., has formed his own consulting business in the pulp and paper, and chemical process industries with offices in New York.

J. B. Calkin

G. E. Purdy

George E. Purdy, formerly with General Chemical Co., has joined the staff of the Tretolite Co. research laboratory at St. Louis, Mo. In his new work, Mr. Purdy will be engaged in the investigation of corrosion problems.

Edwin R. Gilliland, professor of chemical engineering at Massachusetts Institute of Technology, received an honorary doctor of engineering degree from Northeastern University on the occasion of the university's fiftieth anniversary last month.

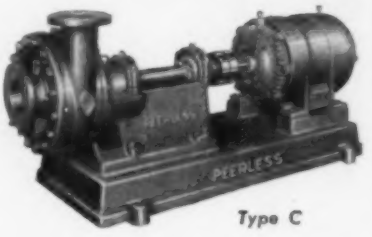
Wayne E. Kuhn, manager of the technical and research division of the Texas Co., New York, has been elected chairman of the division of petroleum chemistry of the American Chemical Society for 1948-49. He succeeds **Gustav Egloff**, director of research of the Universal Oil Products Co.

Henry B. Smith and **Hugh D. Sims** are now associate professors of chemical engineering at Bucknell University and **Raymond E. Vener** is assistant professor. Dr. Smith was formerly in charge of research and development at Air Reduction Co.; Dr. Sims was

TYPE C

PEERLESS *Centrifugal* PUMPS

FOR PROCESS SERVICES



Type C

TYPE C ENCLOSED IMPELLER

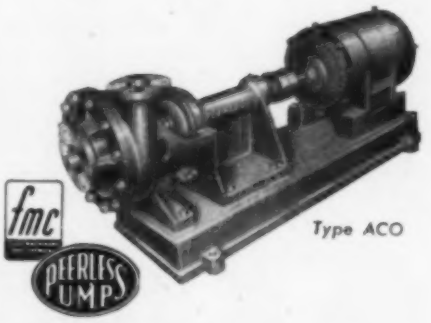
Designed to handle clear liquids which can be of corrosive nature. Single-stage, single-end suction design; range of capacities from 10 to 1200 g.p.m.; heads up to 231 feet; maximum working pressure of 150 lbs.

TYPE CO OPEN IMPELLER

Utilizes an open impeller to permit pumping of fluids up to 750° F with solids in suspension, brines, sludges, etc. Capacities from 10 to 1200 g.p.m.; heads to 231 feet; maximum working capacity of 150 lbs. All forms of drive. Both of the above pumps are described in Bulletin 810.

TYPE ACO FOR ACIDS AND CAUSTICS

Especially designed to pump caustics and acids. Handles fluids up to 800 g.p.m.; heads to 231 feet; maximum working pressure of 150 lbs. Temperatures should not exceed 300° F. Described in Bulletin D-2400.



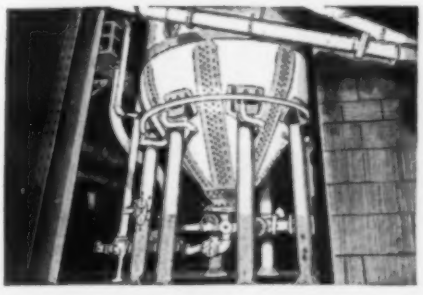
Type ACO

fmc PEERLESS PUMP

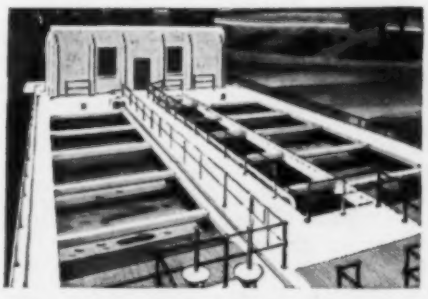
PEERLESS PUMP DIVISION
FOOD MACHINERY & CHEMICAL CORPORATION
Factories: Indianapolis, Ind.; Los Angeles 31, Calif. District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 North Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California.

New Advances In Licking Severe Corrosion

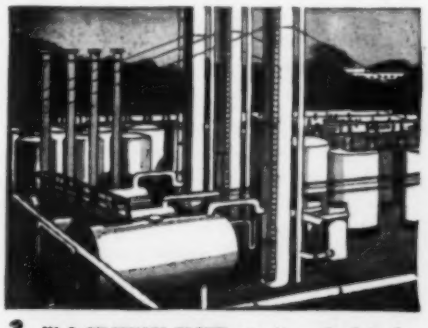
These 4 typical cases show you how, at last, corrosion problems which have defied solution are being licked with UCILON Protective Coatings!



1. IN A PAPER MILL, conveyor pipe for sulphite paper pulp, containing 7% acid and 9% alum, was ordinarily corroded through in 2 months. Coated with Ucilon 400, the pipe lasted 7 to 10 months longer!



2. IN A SEWAGE DISPOSAL PLANT, Ucilon 400 was applied to sedimentation tanks, chlorination equipment, metal work submerged in wet sewage — and outlasted every other coating ever tried! 7 months on steel cover plates used as walks, for example, and no signs of wear!



3. IN A CHEMICAL PLANT, pipelines had to be protected against atmosphere laden with caustic fumes. No former coating lasted even 6 months. But Ucilon 400 was still going strong *22 months* after application!

4. IN AN OIL TANKER, Ucilon-coated panels in the hold were in contact with 100-octane gas, diesel oil, kerosene, salt water ballast. Ucilon 400 coatings were still good *after 10 months!* No previous coating survived even one cargo.

UCILON* 400

Ucilon 400 is a flexible, glossy, air-drying coating for metal, concrete and wood. It is applied by brushing or spraying. When solvents evaporate, a tough "plastic" film is formed. Ucilon 400 provides exceptional resistance to acids, alkalies, alcohols, oils and greases, salts, water, cleaning compounds, oxidizing agents.

OTHER UCILON COATINGS

Ucilon 1601—a ready-mixed, extra-bright aluminum paint with exceptional outdoor resistance. It stays bright under prolonged exposure, withstands elevated temperatures.

•

Ucilon 1501—a very hard, chip-resistant baking coating which resists chemical attack at temperatures higher than recommended for Ucilon 400.

SEND FOR THIS BULLETIN *which gives more details on various Ucilon coatings and their properties.*

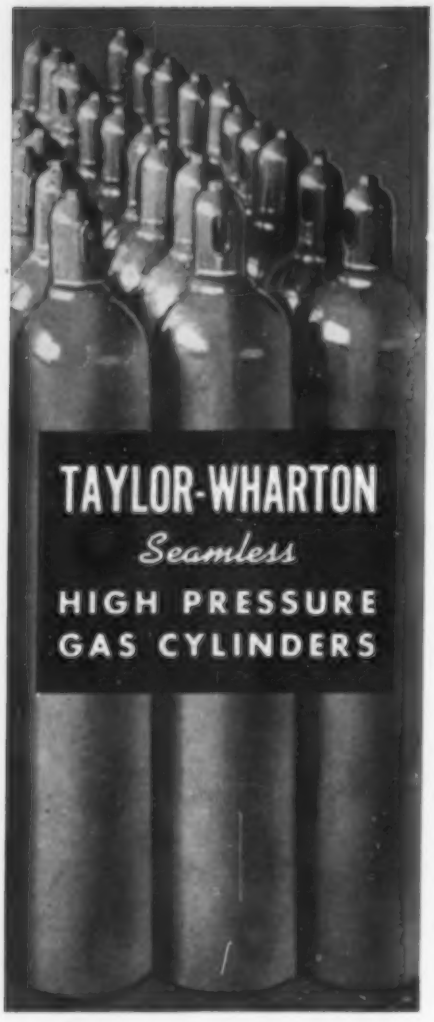
There you have four typical examples of the effectiveness of Ucilon coatings. Company after company, in many industries, have had similar experiences. Until Ucilon 400 was put on the job, they found no real solution to their tough corrosion problems, no end to excessive maintenance. So, if you are still seeking the answer to severe corrosion problems, we invite you with confidence to investigate and try Ucilon. We believe that you will tell us what many other users have—that Ucilon 400 resists *more* corrosives for *longer* periods than any other coating they ever tried. We'll gladly give you specific recommendations for your application. Write today.

*Trade Mark Reg. U. S. Pat. Off.

UCILON Protective Coatings

UNICHROME products of UNITED CHROMIUM, INCORPORATED

51 East 42nd St., New York 17, N. Y. • Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal



Prompt service on your needs for

CHLORINE, OXYGEN, HYDROGEN, CARBON DIOXIDE, NITROUS OXIDE, NITROGEN, ETC.

Diameters up to 13"

• All Taylor-Wharton cylinders are made by the reliable "billet" process to the highest standards of manufacturing, testing and inspecting. Bottoms are integral (not spun), wall thicknesses are carefully controlled for uniformity. Complete, modern facilities to meet all your needs as to quantity, types and sizes. Let us quote on your requirements.

Founded 1742

TAYLOR-WHARTON IRON & STEEL COMPANY

Cylinder Sales Office:
110 E. 42 St., New York 17, N. Y.

HIGH BRIDGE, N. J. & EASTON, PA.
Cable: TISCOSTEEL,
Washington, New Jersey, U. S. A.

with Magnolia Petroleum Co. and Procter & Gamble; Dr. Vener was with the Manhattan Project at Columbia University and the University of Pennsylvania.

Robert B. Magnus has been elected chairman of the Drug, Chemical and Allied Trade Section of the New York Board of Trade. He is vice president of Magnus, Mabee & Reynard, Inc.

L. R. Kessler has been named general manager of the newly formed Pacific Coast division of the Owens-Corning Fiberglas Corp. at Santa Clara, Calif.

George R. Prout has been named assistant general manager of the General Electric Co. nucleonics department. The first of next year he will become general manager, succeeding **R. C. Muir**, who will continue as a consultant. Headquarters for Prout will be Hanford, Wash.

George W. Low, Jr., has been appointed manager of the American Viscose Corp's Sylvania division plant in Fredericksburg, Va.

Duncan A. MacInnes of the Rockefeller Institute for Medical Research, received the Edward Goodrich Acheson Medal and Prize of the Electrochemical Society, October 14.

C. W. Staacke, a member of B. F. Goodrich Co.'s engineering staff for 22 years, has joined Hewitt-Robins Inc. as a technical consultant.

Charles C. Whittelsey has been elected vice president of Ford, Bacon & Davis in charge of construction activities.

P. T. Dashiell, until recently vice president of the Philadelphia Gas Works Co., now associated with United Engineers & Constructors, Inc., Philadelphia, received the AGA Distinguished Service Award last month for having made the most outstanding contribution of an individual toward the advancement of the gas industry. Mr. Dashiell was cited for his contributions in the development of manufactured gas production processes.

H. Marshall Chadwell has been appointed deputy manager of the office of New York directed operations of the U. S. Atomic Energy Commission. Dr. Chadwell will coordinate the technical programs administered by the New York office. These include the production of uranium and other special materials, technical procurement, and medical and scientific research and development at Brook-

Higher Production
LOWER OPERATING COST

TWO outstanding features of Layne Well Water Systems are—Higher Production and Lower Operating Cost. These advantages are the result of excellence in engineering design, plus the proper methods of installation. Such features are of utmost importance in all situations where ground water is used in large quantities: cities, factories, chemical plants, railroads, packing houses, steel mills, refineries, etc.

But Layne is not satisfied to offer higher production and lower operating cost alone. There is the matter of dependable quality and substantial construction. Not once in nearly seventy years of Layne operation has quality been lowered. Today, your Layne Well Water System is better than ever before; tougher where wear is heaviest, more rugged where strength is needed and finer machined for accuracy and smoother operation.

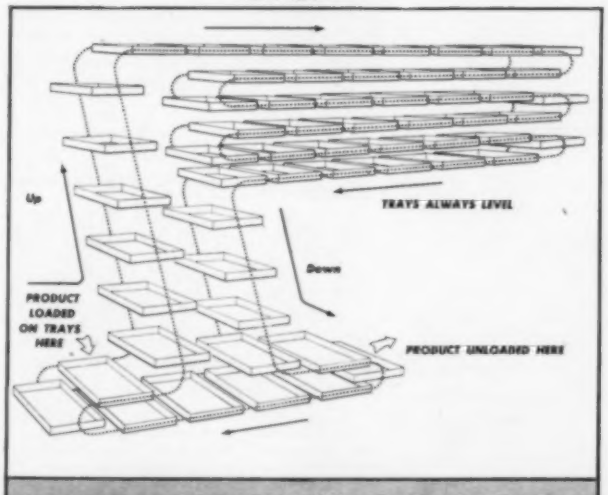
For the best that skill and care can create, plus top flight and proved efficiency at low operation cost, insist on a Layne Well Water System.

For further information, catalogs, bulletins, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

LAYNE
WELL WATER SYSTEMS

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne Central Co. Memphis, Tenn. • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wis. • Layne-Ohio Co., Columbus, Ohio • Layne-Pacific, Inc., Seattle, Wash. • Layne-Texas Co., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Minnesota Co., Minneapolis, Minn. • International Water Corporation, Pittsburgh, Pa. • International Water Supply, Ltd., London, Ont., Can. • Layne-Hispano Americana, S. A., Mexico, D. F.

ARE HANDLING COSTS MANHANDLING YOU ?



"BATCHLESS" PROCESSING

If *your* production costs are high because your product requires frequent handling (removal from your production line for "waiting time") you will profit by converting your operation to *continuous* automatic processing with a Greer Multi-Tier.

In one recent case, the elimination of handling costs alone paid for 85% of a Greer Multi-Tier within the first year.

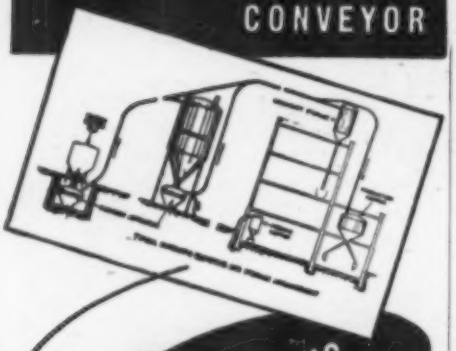
For details on the Greer Multi-Tier, write today for new, descriptive folder.

GREER MULTI-TIER

J. W. GREER COMPANY
124 WINDSOR ST., CAMBRIDGE 39, MASS.

Manufacturers of *Continuous* Production Machinery

ROBINSON
Air-Activated
CONVEYOR



THE PNEUMATIC CONVEYOR

THAT'S DIFFERENT

. . . AND MORE ECONOMICAL

This conveyor is designed to handle DRY-PULVERIZED or FINE-GRANULAR Minerals and Food Products. It is designed to operate with low-volume air and to remove most of the moisture from the air to prevent encrustations in the conveyor pipes. It is designed to operate without continuously moving parts such as screw feed, bearings and other parts which cause high maintenance and require frequent replacement.

The Robinson System uses closed, dustproof equipment, and is showing great economies in handling many kinds of products. It is the product of experienced Materials-Handling Engineers who will be glad to discuss your materials-handling problems when they involve dry-pulverized or granular materials.

Division of MORSE BOULGER DESTRUCTOR CO.

ROBINSON
Air-Activated
CONVEYOR SYSTEMS

211-A East 42nd Street New York 17, N. Y.
Representatives in Principal Cities
Represented in England by Blaw-Knox, Ltd., London
Represented in the French Union and Benelux by Cie Francaise Blaw-Knox, Paris

haven National Laboratory, the New Brunswick Laboratory, and elsewhere in the Northeast.

George W. Ullman has been elected president of the Sun Chemical Corp.

G. E. F. Lundell, internationally known chemist, has retired from active duty as chief of the chemistry division of the National Bureau of Standards, and **Edward Wichers,** former assistant chief, has been appointed division chief. Dr. Lundell will remain on the Bureau staff as consultant to the division. **William Blum,** head of the electrodeposition section, has been appointed assistant chief.

David M. Gans has been appointed director of research of the Arco Co., manufacturers of automotive, industrial and other special coatings. Dr. Gans went to Arco from the Quaker Chemical Products Corp. where he had been technical director.

D. M. Gans

S. L. Nevins

S. L. Nevins has joined Mathieson Chemical Corp. as general manager of the company's newly formed ammonia department. He will have headquarters in Mathieson's New York offices and at its Lake Charles, La., ammonia plant.

Edmund W. Lowe, technical director of Edwal Laboratories will spend a two-year sabbatical leave at Purdue University, where he will hold a research fellowship in the school of chemical and metallurgical engineering.

Frederick A. Gilbert, assistant to the vice president of the Buffalo Electro-Chemical Co., Buffalo, has been elected chairman of the Western New York section of the American Chemical Society.

Robert E. Wilson, chairman of the board, Standard Oil Co. (Indiana), has been named chairman of the committee on research of the board of directors of the American Petroleum Institute.

Robert G. Ruark, formerly Corn Products research fellow at Mellon Institute of Industrial Research, Pitts-

HIGH CORROSIVE FUMES *DO NOT AFFECT** GRID UNIT HEATERS

HIGH TEST CAST IRON HEATING SECTIONS

Here's heating equipment that will stand up under conditions peculiar to chemical plants . . . equipment designed, engineered and constructed for dependable service without maintenance expense.

More "free" area per foot of heating space in GRID unit heaters than any other . . . no clogging due to atmospheric conditions . . . and easier to keep clean and operating at highest efficiency.

*they even withstand High Corrosive fumes of HCl and Cl_2

GRID unit-heaters will stand steam pressures up to 250 lbs. without reducing valves . . . no special piping arrangement necessary.

GRID unit heaters are designed for low outlet temperatures and more air delivery to the floor line—not the ceiling. Hence, real savings in your fuel bills, as warm comfortable air is delivered to the working zone where it is needed.

GRID heating sections are one piece construction high test cast iron—the metal for permanency . . . no electrolysis because there are no dissimilar metals used in GRID construction . . . no maintenance expense—but years of trouble-free service.

Write today for complete details.

Write today for complete details about GRID UNIT HEATERS—to

D. J. MURRAY MANUFACTURING CO.
WAUSAU, WISCONSIN

One of the plates is rolled into shape. These plates are sandblasted to remove the mill scale and clean the surfaces of rust and dirt before being painted.

Cylindrical sections are welded together and the elliptical ends are put on. Longitudinal welding has already been done.

Automatic welder in action. Both the longitudinal and round about seams are welded automatically.

The seams of the tank are being x-rayed. In this process any cracks or flaws in the welds are detected.

It takes more than steel to make a tank . . .

It also takes skill, experience, and equipment — all in large amounts. Some of these extra ingredients are brought to light in the accompanying views which show the fabrication of a cylindrical pressure tank in our Chicago plant.

We build many types of steel plate structures for the chemical processing industry including flat-bottom, spherical and spheroidal storage tanks, cylindrical pressure vessels, and elevated water tanks. We have special facilities for stress-relieving and x-raying pressure vessels when the specifications require it, and we have facilities at our Eastern plant for pickling and painting fabricated steel plates.

The next time you need steel plate work, write our nearest office and outline your requirements.

The tank is tested hydrostatically.

On the flat car ready to go.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3 ..... 2120 Healey Bldg.	Detroit 26 ..... 1503 Lafayette Bldg.	Philadelphia 3 ... 1625—1700 Walnut St. Bldg.
Birmingham 1 ..... 1510 North Fiftieth St.	Havana ..... 402 Abreu Bldg.	Salt Lake City 1 .. 1505 First Security Bank Bldg.
Boston 10 ..... 1005-201 Devonshire St.	Houston 2 ..... 2103 National Standard Bldg.	San Francisco 11 .... 1222—22 Battery St. Bldg.
Chicago 4 ..... 2124 McCormick Bldg.	Los Angeles 14 ..... 1405 Wm. Fox Bldg.	Seattle 11 ..... 1303 Stuart Bldg.
Cleveland 15 ..... 2220 Guildhall Bldg.	New York 6 ..... 3318—165 Broadway Bldg.	Tulsa 3 ..... 1623 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Reduce your filtering costs!

THORATEX
REG U S PAT OFF

IMPREGNATED COTTON FILTER FABRICS

—Last longer
—reduce overhead
—increase output

HERE'S WHY

- Frequently outlast untreated cloth 3 to 1
- Resists corrosive action of caustic and alkaline solutions
- Mildew and rot resistant
- Maintains filtering capacity
- Smooth surface
- Cakes come away easily
- Reduces gumming
- Fewer washings required
- More continuous press operation
- Less shrinkage on press
- May be used in cold or boiling filtrations
- May be used with hydrocarbon solvents
- Better filtration
- Soft, flexible—sews easily

FREE TRIAL

Send us, prepaid, a roll of your cloth for finishing. Try it under actual plant operations.

Information and samples on request

SPRINGDALE FINISHING SOUTH, Inc.

Sales office
320 Broadway, New York, N. Y.
Mill: Whitney, So. Carolina

burgh, Pa., has been made assistant to the general manager, chemical division, Corn Products Refining Co., Argo, Ill.

Edgar G. Hill, for many years a vice president and director of Ford, Bacon & Davis, has retired from active service but will continue with the organization in the capacity of a consultant.

George R. Milne has been appointed operating manager of the National Carbide Corp. Simultaneously with the promotion of Mr. Milne, **Russell T. Lund** was made assistant operating manager. Mr. Milne will continue to have his headquarters at Carbide's Louisville plant. For the present, Mr. Lund will have his headquarters at the Ivanhoe, Va., plant.

OBITUARIES

Richard C. Tolman, dean of the California Institute of Technology Graduate School and one of the developers of the atom bomb, died in Los Angeles September 5.

William Charles Mast, 62, senior construction engineer of the Chemical Construction Corp. died in New York, September 17.

William B. Lawson, 64, president and treasurer of the Ferro Chemical Corp., died in Cleveland September 29.

Samuel E. Sheppard, 66, in retirement since January 1948 after 35 years with Kodak Research Laboratories, died in Rochester September 29.

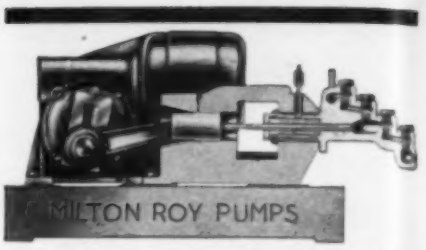
William Roth Work, 67, assistant director of the college of engineering and science, Carnegie Institute of Technology, and one of the school's first faculty members, died in Pittsburgh October 3.

Ralph B. Roe, technical director of the Sorg Paper Co. for 25 years, died in Middletown, Ohio, October 6.

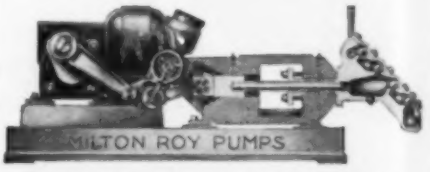
Horace T. Herrick, special assistant to the chief of the Bureau of Agricultural and Industrial Chemistry, died in Washington October 7.

Clark E. Husted, 66, who before his retirement July 1, 1947, was a vice president of the Libbey-Owens-Ford Glass Co, died in Toledo October 10.

John D. Fleming, 58, a member of the organic sales development department of Monsanto Chemical Co., died of a heart attack at his home in St. Louis October 12.



Stroke Adjustment—Screw. Liquid End—Alloy.



Stroke Adjustment—Micro while running. Liquid End—Cast Iron, cover plate design.

MILTON Roy CHEMICAL PUMPS

for Accurate Control of Volume

Milton Roy Pumps are positive metering units for controlled volume pumping in which the length of the plunger stroke is quickly and easily adjusted to regulate the volume of liquid pumped. Precise control in pumping small volumes is thus made possible, down to as little as 1 pint per hour.

Milton Roy Pumps handle difficult materials—slurries and solids in suspension, viscous liquids, solvents, hot or cold oils, other materials too difficult or perhaps impossible to pump by other means.

Liquid ends of Milton Roy Pumps are supplied in any metal or alloy that can be cast and machined, also in certain plastics materials, to meet practically all corrosion resistance requirements.

Milton Roy Pumps are high pressure pumps, up to 20 thousand psi, for high pressure catalysis, hydrostatic testing and similar applications.

Investigate the pump that is tailor-made for each specific purpose—to handle materials in exactly controlled volume. Ask for Catalog No. 146.

MILTON Roy COMPANY
1372 E. MERMAID AVE. CHESTNUT HILL PHILA. 18 PA.

THERE'S ALWAYS A HIGH RECOVERY OF SOLIDS WITH **BUFLOVAK** LOW TEMPERATURE EVAPORATORS . .

Operating at extremely low temperatures and safe pressures, the new BUFLOVAK Low Temperature Evaporators safeguard the good qualities of your concentrated product. Delicate materials are concentrated safely, quickly . . . and with a HIGH RECOVERY OF SOLIDS.

Successful and profitable operations, day after day, and over long operating periods, are assured by automatic controls.

Profits are increased by maintaining high product quality, at low production cost. There are no royalties to deduct from profits! BUFLOVAK equipment is sold outright with protective performance guarantees!

You are cordially invited to write for full details of the new BUFLOVAK Low Temperature Evaporator. There is also a type BUFLOVAK Evaporator built to profitably fill every industrial requirement.

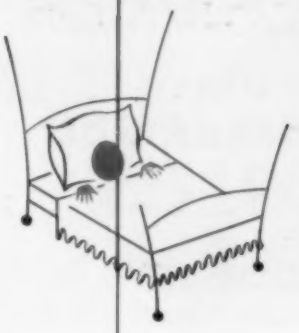
Other BUFLOVAK Equipment for processing chemicals and foods include Dryers, Solvent Recovery Equipment and Processing Equipment. Literature on request.

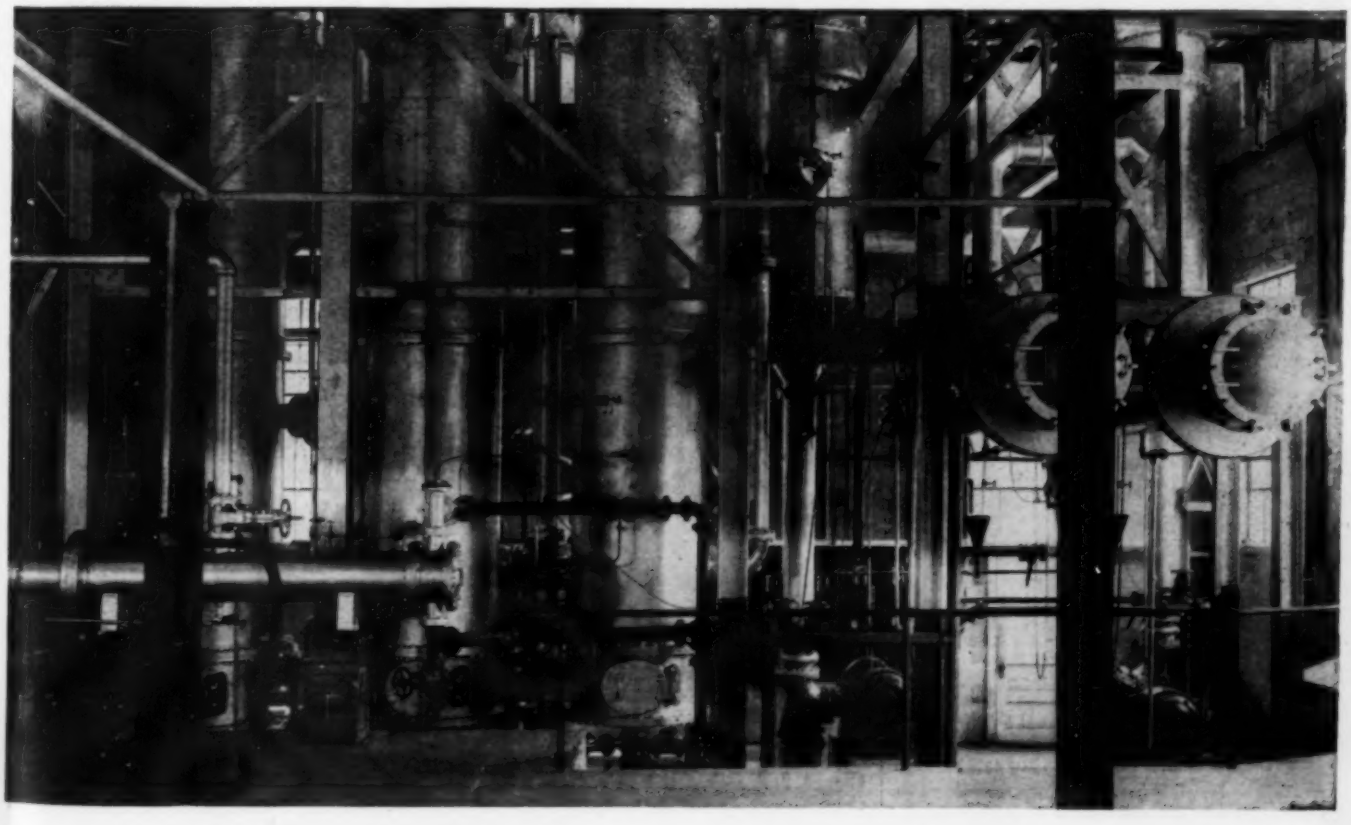
BUFLOVAK EQUIPMENT

Division of Blaw-Knox Co.

1551 FILLMORE AVE. BUFFALO 11, N. Y.

Safe Treatment for Delicate Materials





WORKS WHERE OTHERS WON'T

for

SUBMERGED OILLESS BEARINGS

SPECIFY GRAPHALLOY WITH CONFIDENCE

- OPERATE *DRY* or *SUBMERGED* IN DYES, PLATING, CLEANING & CHEMICAL SOLUTIONS, GASOLINE, FOODSTUFFS
- TRULY OILLESS AND SELF-LUBRICATING
- EXTREMELY DURABLE
- CONSTANT COEFFICIENT OF FRICTION
- APPLICABLE OVER A WIDE TEMPERATURE RANGE—even where oil solidifies or carbonizes
- EXTENSIVELY USED IN CONVEYORS, PUMPS & OVENS
- ROTATING SEALS OF GRAPHALLOY ARE UNEXCELLED

GRAPHITE METALLIZING CORPORATION

1024 NEPPERHAN AVENUE, YONKERS 3, NEW YORK

INDUSTRIAL NOTES

Ethyl Corp., New York, has appointed Harry Kuhe manager of the chemical sales division, a new post with the company.

Houdry Process Corp., Philadelphia, will install a Houdriflow Catalytic Cracking Unit at the Blue Island, Ill., refinery of the Petco Corp.

Armour and Co., Chicago, has named D. E. Shea as sales manager of its household soap division. He replaces B. B. Freitag who has assumed the duties of sales manager of the Armour toiletries division.

Hy-R-Speed, Inc., San Francisco, has appointed Holland W. Smith, Inc., as sales agents for the states of Maryland, Delaware, New Jersey, New York and Pennsylvania east of Harrisburg.

Oliver United Filters Inc., New York, has placed Russell Runyon in charge of purchasing at the Hazleton, Pa., plant.

American Cyanamid Co., New York, has appointed Arthur J. Campbell division manager of the industrial chemicals division.

Food Machinery Corp., San Jose, Calif., has officially changed its name to Food Machinery and Chemical Corp.

Cyclotherm Corp., New York, has named P. M. Pottetti sales manager.

A. E. Staley Mfg. Co., Decatur, Ill., has appointed W. Wilson Seay a salesman in its special products division.

Ampco Metal, Inc., Milwaukee, Wis., now has three additional distributor outlets. They are: Welding Engineering Sales Corp., Buffalo and Syracuse, N. Y.; Southern Oxygen Co., Inc., Knoxville, Tenn.; Arizona Welding Equipment Co., Phoenix, Ariz.

Blackmer Pump Co., Grand Rapids, Mich., has established a branch sales office at 608 South Dearborn St., Chicago. William H. Maloney has been appointed manager of the company's Los Angeles branch sales office.

General Electric Co., Schenectady, has named George R. Prout an assistant general manager of the G.E. nucleonics department. Harold F. Smiddy

CHEMICAL FUMES ARE SEALED IN!

Fumes cannot leak through the stuffing boxes in Taber Vertical Pumps because the load liquid does not come into contact with these packings.

If your pump job is movement of concentrated sulphuric or other fluids, please write on your letterhead for a copy of our Special Bulletin V-837 which details the dependability of Taber Vertical Pumps for mounting in processing and storage tanks, or in vessels sealed against fumes or gases.

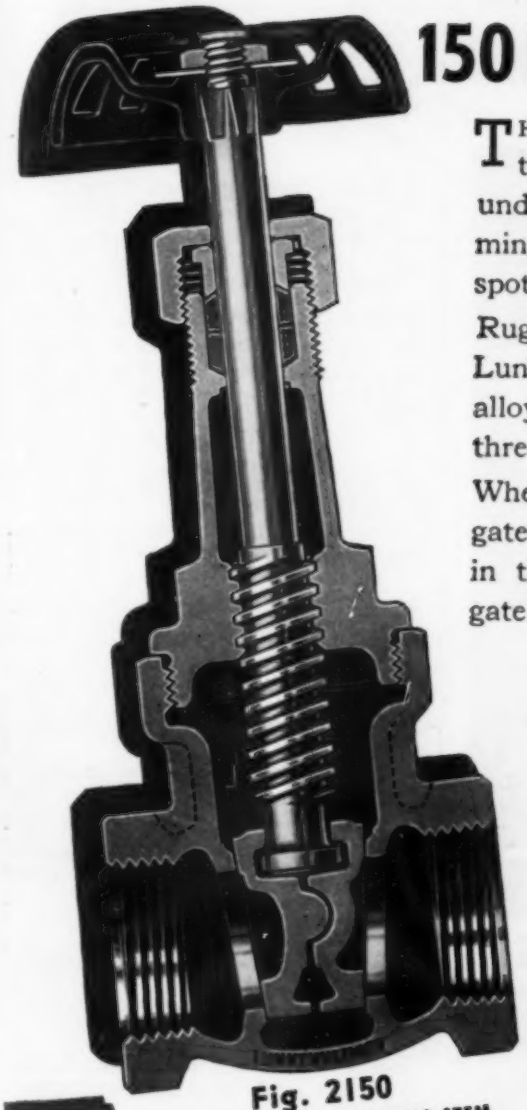
TABER PUMP CO.
294 ELM ST. • BUFFALO 3, N. Y.
ESTABLISHED 1859

5430

TABER PUMPS for Higher Practical Performance

"LIKE HAVING THREE VALVES IN ONE"

LUNKENHEIMER



150 lb. S.P. BRONZE GATE VALVES

THE enthusiasm of maintenance men *and* engineers for the Lunkenheimer new 150 lb. Bronze Gate Valves is understandable. Actually, a simple interchange of trimmings provides, from minimum stocks, a valve for every spot where a 150 lb. Bronze Gate Valve is needed.

Ruggedly designed throughout, each valve features the Lunkenheimer developed and patented wear-resistant alloy stem material which eliminates failures due to stem thread wear.

Whether you have one . . . or thousands of 150 lb. bronze gate valves in your plant, you'll find definite advantages in the LUNKENHEIMER Fig. 2150 line of 150 lb. gate valves.

PHONE YOUR DISTRIBUTOR . . .

Design, construction and interchangeability are fully illustrated and described in Circular 574. Ask your distributor for a copy or write us direct.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

NEW YORK 13 CHICAGO 6 BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

Fig. 2150
DOUBLE WEDGE DISC, RISING STEM

See Our Exhibit at the 18th National Exposition of Power and Mechanical Engineering. Booth #52, Grand Central Palace, New York. November 29th - December 4th.

FIG. 2153...

Embodies all the features in Figs. 2150 and 2151, but its design is varied to provide non-rising stem operation. Body is the same thus requiring only an interchange of trimmings, to convert from the non-rising stem to the rising stem valve.

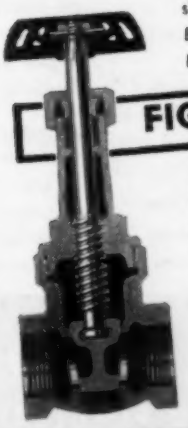


FIG. 2151...

SOLID WEDGE DISC. The solid disc is ideal for services such as food processing lines and handling gummy substances, where entrapment of line materials within the disc is undesirable.

SWITCH TO PORCELAIN *for* INSURANCE *against* CONTAMINATION

In handling liquids and semi-liquids, install ILLINOIS porcelain pipe and fittings for a permanent means of handling materials.

ILLINOIS PORCELAIN SYSTEMS FOR HANDLING LIQUIDS GIVE YOU THESE ADVANTAGES:

1. Smooth, corrosion-proof inside surfaces. No pitting or rough spots on pipe's inner walls.
2. Acid and alkali-resistant porcelain withstands tendency to fracture or corrode.
3. Illinois porcelain pipe prevents wet spots caused by condensation.

WITH ILLINOIS PORCELAIN PIPE LINES YOU GET . . .

★ *Quality Control*
No changes in composition of material during its handling in the plant.

★ *No Electrolitic Action*
Non-absorbent porcelain does not pick up minerals or metals in material being handled.

★ *Production Cost Savings*
Corrosion-proof porcelain cuts maintenance. Spoilage in materials is reduced because porcelain is permanent.

Write today for illustrated catalog #C-2, covering the ILLINOIS line of standard porcelain products. Types and sizes to meet your specific requirements. Your inquiries concerning special porcelain needs are welcome.

CHEMICAL

ILLINOIS
ELECTRIC PORCELAIN CO.

has replaced him as general manager of the air conditioning department. Mr. Smiddy continues as general manager of the chemical department.

Research Corp., New York, has appointed S. Blake Yates to the division of patent management.

Owens-Corning Fiberglas Corp., Toledo, has established a Pacific Coast division to handle manufacturing and sales operations for the Coast and neighboring states. W. C. Winterhalter will be sales manager. He was formerly manager of the West Coast sales office.

Eutectic Welding Alloys Corp., New York, has appointed Paul E. Miller and Jack R. Koske to the board of regional sales supervisors.

United States Steel Corp., Chicago, has made J. Norman Quinlan assistant to general superintendent of the Gary plant of its subsidiary, the Carnegie-Illinois Steel Corp.

Quaker Oats Co., Chicago, has made Imperial Chemical Industries Ltd. sole selling agents in the United Kingdom for furfural.

U. S. Bureau of Mines, Seattle, has begun research on possible methods of using Washington state coal as a source of coke for making electrodes used in aluminum reduction.

Hercules Powder Co., Wilmington, has declared a regular quarterly dividend of 1¼ percent equal to $1.25 a share on its preferred stock, payable November 15 to stockholders of record November 4.

Hammel-Dahl Co., Providence, has appointed Arduser and Co., Tulsa, Okla., as their dealer representative.

David Gordon & Co., Engineers, New York has established associated offices in Montevideo, Uruguay, under the direction of Eduardo Araujo and in Tananarive, Madagascar, under the direction of M. Akbaraly.

Continental Can Co., New York, has started production of Leverpak shipping drums on November 15 at its new fiber drum plant in Tonawanda, N. Y.

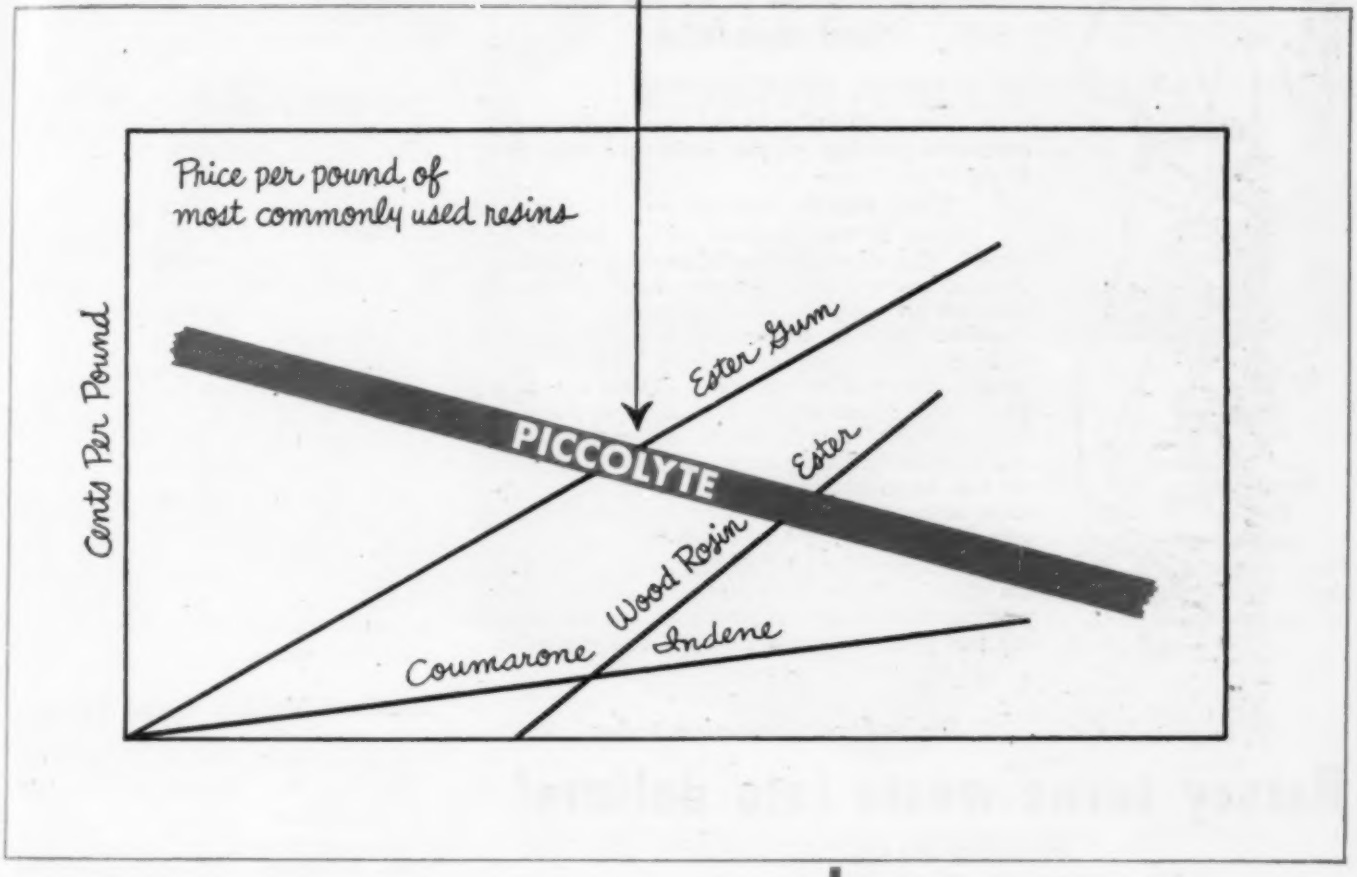
Wigton-Abbott Corp., Plainfield, N. J., has formed a chemical engineering and process design division to complement its present general engineering and construction services.

Shell Oil Co., San Francisco, will combine western operations with those in the East the first of next year to co-

Piccolyte

the Versatile Resin

costs less today than ever before



and gives you these plus values

PALE COLOR, NON-YELLOWING. These pure hydrocarbon products do not become yellow, but retain their pale color.

READILY SOLUBLE. Piccolyte is a thermoplastic terpene resin, soluble in low-cost naphthas, as well as in coal tar solvents, mineral oils, chlorinated hydrocarbons, long chain ketones and long chain alcohols.

CHEMICALLY INERT. Piccolyte resists acids, alkalies, salt. It is compatible with waxes, resins, paint and varnish oils, bituminous materials, paraffin oils, rubber, and many other materials. Made in nine melting points.

Write for free sample of Piccolyte, and complete details, given in the new bulletin. Use the coupon.

PENNSYLVANIA
INDUSTRIAL CHEMICAL CORP.
CLAIRTON, PA.

Pennsylvania Industrial Chemical Corp.
Clairton, Pennsylvania

Please send me a free sample of Piccolyte, and your new bulletin. I wish to investigate Piccolyte for (application) .....

Name .....

Company .....

Address .....

(CE)

Cranberry Growers process waste Harvest another kind of "berries"

Another triumph of Hersey dryers and engineering

You won't find pulp and waste in the canned cranberries you buy, yet they make up a large part of the crop.

Where does the waste go? —

Once it was disposed of — dumped or burned. Then chemists at a Massachusetts packing plant discovered that, properly dried, cranberry skins are an excellent source of ursolic acid (an emulsifier used in cosmetic manufacturing), the seeds rich with expensive cranberry seed oil. They brought their problem to Hersey. "Build us a dryer which will economically recover these valuable products," they said. So Hersey engineers designed and built two-stage drying equipment which filled the bill. Installed at the packing plant, this equipment now converts waste into by-products *more valuable than the original cranberry crop.*

Are you dumping dollars because you lack the right recovery equipment? Let Hersey study your problem — their recommendations cost nothing, may point the way to new profit opportunities.

Write for information today.

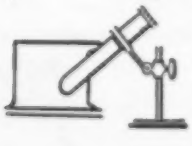
Hersey turns waste into dollars!

PICKLING WASTE

Metal product manufacturers using Hersey equipment are recovering zinc sulfate, anhydrous and the crystals of ferrous sulfate from pickling waste formerly dumped.

SWEET POTATO PULP

A feed manufacturer is using Hersey equipment to convert sweet potato pulp into cattle feed.



BEET SUGAR WASTE

From the Steffens Water derived in beet sugar production, a San Jose, California plant is recovering glutamic acid with Hersey drying equipment.

hersey • dryers

Division Hersey Mfg. Co. • E & Second Streets • So. Boston, Mass.

ordinate nation-wide activities. Western executive offices will be moved to New York, but the number of personnel transfers will be small.

Sterling Drug Inc., Cincinnati, Ohio, has named Nelson S. Knaggs divisional vice president in charge of sales of the Hilton-Davis Chemical Co. division.

Hagan Corp., Pittsburgh, has elected D. J. Erikson president of the company and its subsidiary companies—Calgon, Inc., Hall Laboratories, Inc., and Buromin Co. He replaces John M. Hopwood who has been elected to the new position of chairman of the board of directors.

United States Steel Corp., New York, has opened a San Francisco district office of the coal-chemical sales division.

International Paper Co., New York, has opened a branch sales office of its Bagpak division in San Francisco. W. A. Scholl has been named district sales manager.

Capital City Products Co., Columbus, has launched a $250,000 program which will take it into the industrial chemical field for the first time in its history. Construction has started on a $40,000 plant addition which will house equipment for distilling free fatty acids. The company will be able to distill the acids and sell direct to industrial consumers. Production will start next spring.

Pettibone Mulliken Corp., Chicago, has appointed S. DeVries exclusive sales representative for its George Haiss Mfg. Co., Inc., division in the state of Connecticut.

Olin Industries, Inc., has appointed Huntley M. Campbell sales manager of the mill products division of the Western Brass Mills division.

Hewitt-Robins Inc., Buffalo, N. Y., has appointed Franklin L. Klocke as factory representative for the Hewitt Rubber division in North Carolina and Virginia and the Hewitt Restfoam division in the Southeast.

Norwich Pharmacal Co. has transferred its executive offices to a new five-story administration tower adjacent to the plant at Norwich, N. Y.

York Corp., York, Pa., has elected Marshall G. Munce a vice president.

Society of the Plastics Industry, New York, recently sponsored special meetings featuring reports by government representatives on plastics products

THERE'S SERVICE BEHIND THIS PUMP!

Gardner-Denver Horizontally Split-case Double Suction Centrifugal Pump —one of many Gardner-Denver types.

Two things are needed to provide complete satisfaction when you buy a centrifugal pump—a quality product *and* quality service. For often you want skilled advice in choosing exactly the pump for your needs—advice backed by research and field experience. Often, too, you require friendly, expert help in getting the most out of your pump after it is installed.

All Gardner-Denver Centrifugal Pumps are sold with this backing of service—always at your command—always available at your call. Gardner-Denver branch offices, located in principal centers throughout the country, stand ready to keep your Gardner-Denver pump at peak efficiency year after year.

For superior pumps—AND superior service—write Gardner-Denver.

Gardner-Denver Company, Quincy, Illinois

GARDNER-DENVER SINCE 1859

Outstanding among its great variety of mineral resources readily available for chemical manufacturing is Oklahoma's tremendous reserve of high grade silica, in several forms:

Glass Sand. Equal in chemical quality to any in the United States and used by glass plants in Oklahoma and adjacent states since 1913.

Tripoli. This state has long been an important supplier of tripoli, in 1944 ranking third in national production.

Novaculite. Outcroppings of more than 100 square miles in southeastern Oklahoma are a continuation of the outcrops in southwestern Arkansas where novaculite has been produced for many years and where chemical analysis shows silica content to be 99% or more.

Vein Quartz. Very large deposits of milky variety are easily accessible.

Chat and Slimes. Millions of tons of highly silicious material are available as by-products of zinc mining in northeastern Oklahoma.

TYPICAL ANALYSIS OF SILICA GLASS SAND FROM ARBUCKLE MOUNTAINS

Average of Plant Run — 1947

SiO_2	99.829
Fe_2O_3	0.036
Al_2O_3	0.072
CaO	0.009
MgO	0.005
L. O. I.	0.072
Total	100.023

Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.

for the Ordnance Department, Signal Corps and Quartermaster Corps, Bureau of Ships and Chemical Corps. These meetings were coincident with the Third National Plastics Exposition.

Atlas Chain and Mfg. Co., Philadelphia, has appointed O. W. Schmidt as its central states district sales manager.

National Lead Co., New York, has taken over the business of Titanium Alloy Mfg. Co.

Askania Regulator Co., Chicago, has elected C. E. Tweedle vice president.

Vapor Recovery Systems Co., Compton, Calif., has appointed J. L. Johnson and Robert A. Stanley to the technical sales staff as sales engineers.

Koppers Co., Inc., Pittsburgh, Pa., has elected Arthur B. Van Buskirk a member of the board of directors.

American Marietta Co. has made Harry N. Walker director of purchases.

Link-Belt Co., Chicago, has appointed H. F. R. Weber the representative of the company to the pulp and paper industry.

Sharp & Dohme, Inc., Philadelphia, has named Raymond Underwood resident patent counsel.

Allis-Chalmers, Milwaukee, Wis., has made B. F. Bilsland manager of its newly formed Midwest region.

Libbey-Owens-Ford Glass Co., Toledo, Ohio, has combined the top management of its East Toledo laminating and plate glass polishing plants.

Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has appointed Carl J. Lamb consulting engineer.

Arcos Corp., Philadelphia, has made Charles B. Culbert, Jr., company representative in the Boston area.

Clarostat Mfg. Co., Inc., has moved its operations to Dover, N. H.

Monsanto Chemical Co., St. Louis, Mo., has appointed Kenneth W. Short acting purchasing agent for its plastics division.

Goodyear Tire & Rubber Co., Akron, Ohio, celebrated its fiftieth anniversary with a three-day program beginning October 6.

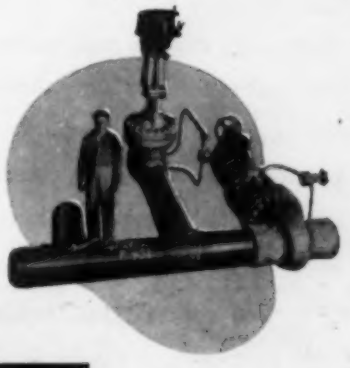
U. S. Tariff Commission, Washington, has issued a preliminary report on United States production and sales in

HEAT TREATING ALLOY PIPING is a matter of experience, also

Heat treating alloy piping is as "fussy" as baking a cake. If not done exactly right, quality can be seriously impaired. It takes plenty of experience as well as scientific metallurgical control to heat treat alloy piping.

Stress relieving to remove residual stresses . . . annealing or normalizing for desired grain structure . . . proper heat treatment of alloy piping for maximum strength, toughness, high temperature stability, or maximum corrosion resistance. Method of heating, time, temperature, cycle for heating and cooling, cooling method, etc., must be carefully regulated by experienced men. Too rapid heating or cooling will crack some alloys. Improper heating may create undesirable microstructure, impair physical properties or destroy corrosion resistance. Pitfalls are many.

With the right equipment . . . the scientific metallurgical control . . . and the trained and experienced men, Qualified Pipe Fabricators do heat treating *right*. They produce better piping . . . often save you money in first cost . . . always in the long run.



THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

P.F.I. THE PIPE FABRICATION INSTITUTE

WILLIAMS

HEAVY DUTY CRUSHERS PULVERIZERS . . . SHREDDERS

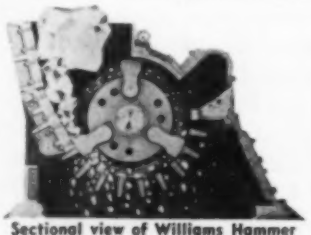
"SLUGGER" TYPE
CRUSHER
FOR CRUSHING CRUDE MATERIAL

Many successful installations attest their dependability and low operating cost

● No matter what the job requires, there is a standard Williams machine for the reduction requirements. Capacities range from 50 pounds to 300 tons per hour, permitting selection of exactly the proper size for your work.

The "Slugger" Type shown above is ideal for the primary reduction of crude ores, etc. Crushes by the Williams Hammer Principle, with rows of heavy, free swinging, fast revolving hammers crushing the material by impact until of proper size to pass through the grates. The ideal machine for the job.

We solicit your inquiries



Sectional view of Williams Hammer Crusher showing how the heavy, free swinging hammers reduce the material to desired size.

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 North Ninth St. St. Louis 6, Mo.

Sales Agencies Include

CHICAGO 5
37 W. Van Buren St.

NEW YORK 6
115 Broadway

PHILADELPHIA 2
15th & Market Sts.

1947 of synthetic organic chemicals and their raw materials.

Instrument Development Laboratories, Inc., Chicago, has changed its name to the Nuclear Instrument & Chemical Corp.

Joseph T. Ryerson & Son, Inc., Pittsburgh, held open house at its Pittsburgh area steel-service plant September 10 and 11.

Elgin National Watch Co., Aurora, Ill., has changed the name of its Sapphire Products division to the Industrial Products division.

Farrel-Birmingham Co., Inc., Ansonia, Conn., has made Robert M. Honegger a member of the board of directors.

Goodyear Tire & Rubber Co., Akron, has completed the organization of a new foam-rubber division.

Wheelco Instruments Co. has opened a new office at 138 East Becher St., Milwaukee. M. A. Embertson is in charge of the new office.

Allis-Chalmers Mfg. Co., Milwaukee, has appointed W. L. Manly manager of dealer sales succeeding W. A. Meyer who has been named assistant managaer of the Texrope drive department.

Shell Chemical Corp., New York, is constructing the first unit in what may become a complete plant for making oil-derived synthetic detergents in Wood River, Ill.

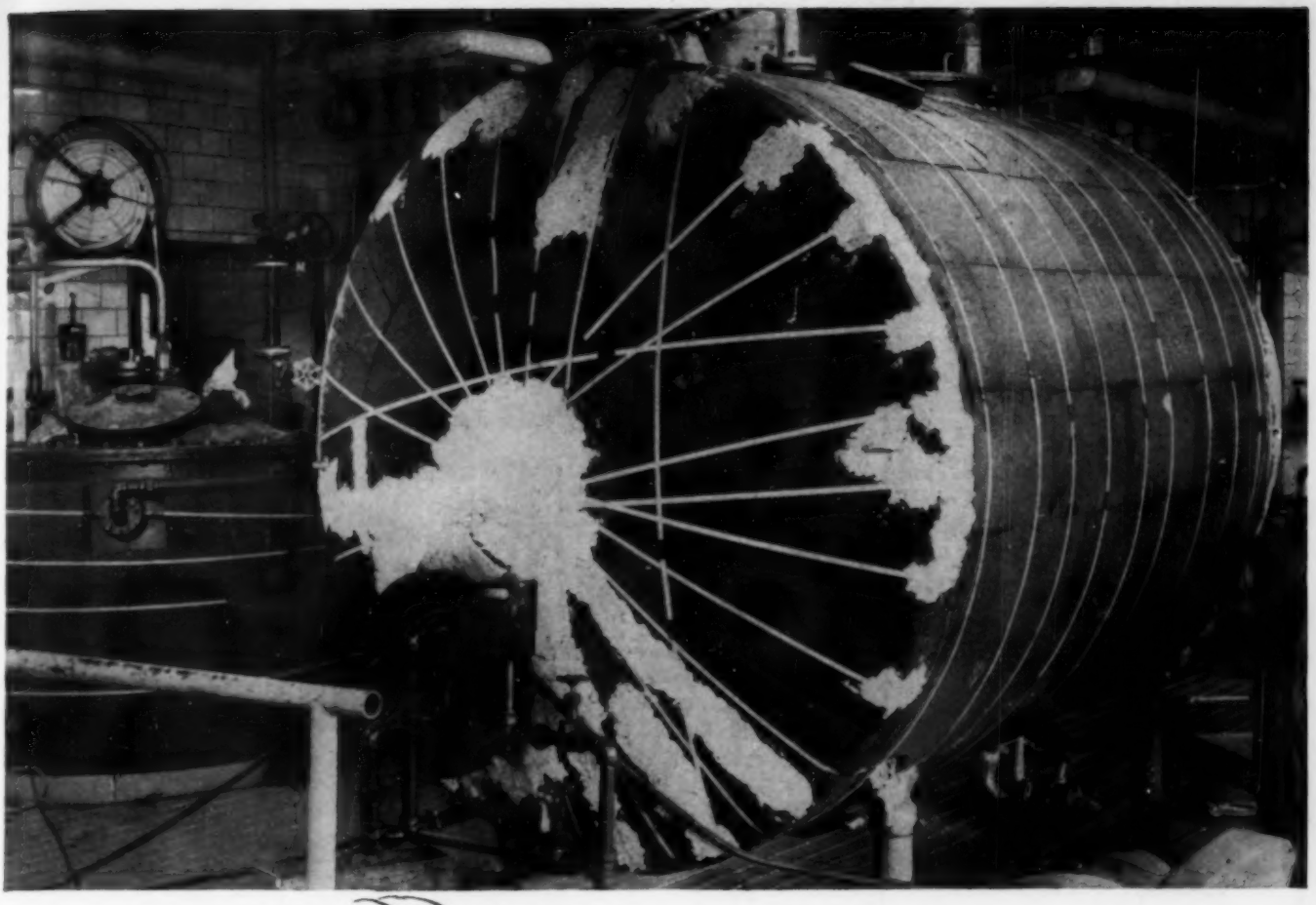
Clark Bros. Co., Inc., Olean, N. Y., has appointed T. C. Webb district manager of the Caracas, Venezuela, office.

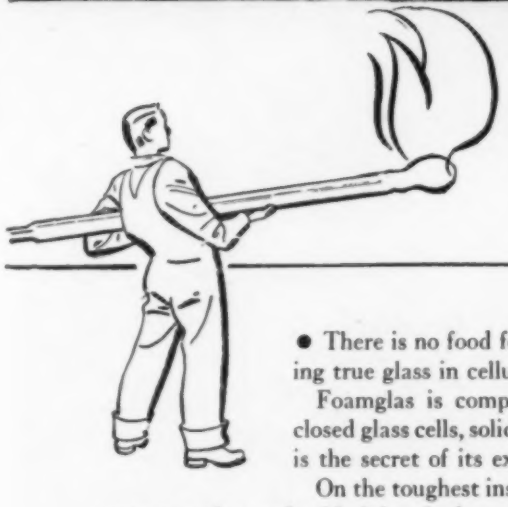
De Laval Steam Turbine Co., Trenton, N. J., has appointed J. A. Greenland district manager of the Seattle office.

Cowles Detergent Co., Cleveland, has changed its name to Cowles Chemical Co.

Lion Oil Co., El Dorado, Ark., has appointed Ray D. Cunningham manager of its protective coatings department, sales division. In the next four months the company will construct a plant at El Dorado devoted to the manufacture of protective coatings.

Lincoln Engineering Co., St. Louis, Mo., has appointed Morgan B. Lawton to serve as manager of Lincoln Lubricating Systems, Inc., Cleveland, in addition to continuing as manager of its sales branch in Detroit.





It's Fireproof!

That is one of the main reasons why PC Foamglas is the permanent insulation

• There is no food for the flames in PC Foamglas. Being true glass in cellular form, it will not burn.

Foamglas is composed of millions of tiny air-filled closed glass cells, solidified into strong, rigid blocks. That is the secret of its excellent insulating properties.

On the toughest insulating jobs—on tanks, towers and retorts, on hot and cold piping, in ducts and breeching, on heat exchangers, evaporators and other processing equipment—PC Foamglas helps to maintain predetermined temperatures from minus 350°F. to 800°F.

It is an effective vapor stop, withstands humidity, resists fumes and acid atmospheres. Since it is also waterproof and verminproof, PC Foamglas — when installed according to our specifications for recommended applications—retains its original insulating efficiency *permanently*.

Our insulating specialists will be glad to consult with you on your individual insulating problems and tell you how Foamglas can best be used to solve them. Just drop a line—without obligation—to Pittsburgh Corning Corporation, Room 516-8, 632 Duquesne Way, Pittsburgh 22, Pa.

THE MAGNIFIED CROSS SECTION of PC Foamglas shows its cellular structure . . . glass bubbles solidified into big, strong, rigid blocks. In the millions of cells of glass-enclosed air, lies the secret of its insulating value.

Pittsburgh Corning Corporation also makes PC Glass Blocks

PITTSBURGH PC CORNING

FOAMGLAS INSULATION

FOR ADDITIONAL INFORMATION SEE OUR INSERTS IN SWEET'S CATALOGS.

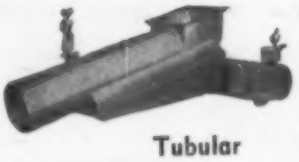
When you insulate with FOAMGLAS . . . you insulate for good!

SYNTRON

"Vibra-Flow"

VIBRATORY FEEDERS

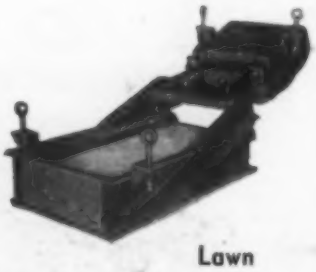
Flat Pan



Tubular

Spreader

Grizzly



Lawn

Speed Up Material Handling

— by their ability to handle bulk materials, from light, fine powders to heavy, coarse chunks—hot or cold—dry or damp—by providing variable control of rate of flow to meet the capacities of dryers, screens, crushers, belt conveyors, etc.

Write for illustrated folder

SYNTRON CO.

610 Lexington Homer City, Pa.

CONVENTION PAPER ABSTRACTS

CONTENTS

Fertilizer From Houses	292	Working for Uncle Sam	314
Separating Cresols	294	M Means Mobilization	318
New Pain Killer	294	Plastic Fertilizer	320
One of a Hundred	296	Continuous Viscosimeter	320
Fir Tannin for Tanning	296	Biogeochemical Provinces	322
Costs of Fuel From Coal	298	Long Skirts, Short Dyes	322
Micronutrients	300	Plasticization	324
Unreasonable and Uneconomical	302	Molasses Alcohol	326
Methoxychlor	304	Iso-Octyl Alcohols	328
New Sugar Process	306	Promethium	330
Polyelectrolytes	308	Sulphur Data	332
Suicide on the Farm	310	Longevity Fallacy	332
Cresylic Acid	312	Proteins and Amino Acids	334

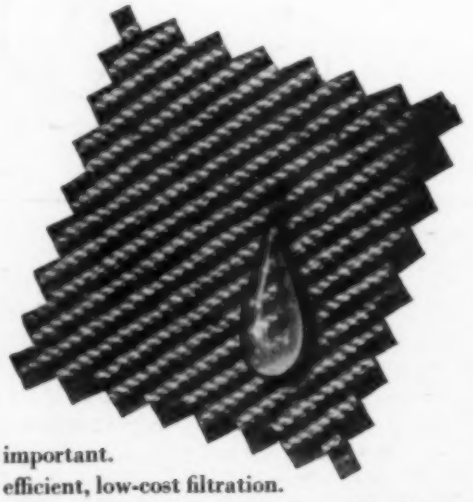
3 Tons Lime + 0.8 Tons Potash = 1 Ordinary House (Burned)

PROBABLY most of the increased crop yields reported by Japanese farmers after the atomic bombings in Hiroshima and Nagasaki can be attributed to the beneficial effects of burned soil and especially to ash accumulated from organic matter and burned buildings rather than to the effects of radioactivity per se.

The use of burned soil as fertilizer is common in some parts of Japan. Burning soil increases the availability of nitrogen and some other plant foods in the soil. The soil is heated in large cauldrons to a temperature of 100 to 200 deg. C.

Large amounts of ash were added to the soil by the bombings and, in many cases, land was cutivated which formerly was occupied by buildings. Japanese scientists have estimated that

the right filter base



■ Choice in filter bases is important.
The right type is necessary for efficient, low-cost filtration.
Let Sperry recommend it for you. We've had more than 50 years filtration experience. And we have a complete stock of bases—covering a wide range of industrial applications.

Sperry engineers have developed bases in paper, cloth, vinyon, asbestos, rubber, glass and woven materials. If a special type is indicated, Sperry can supply that.

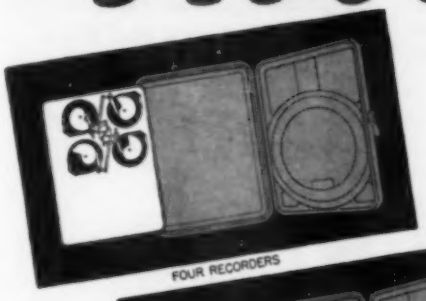
Whatever your filtration problem, call in Sperry today for an accurate analysis. Chances are you'll increase production efficiency. There's no obligation.

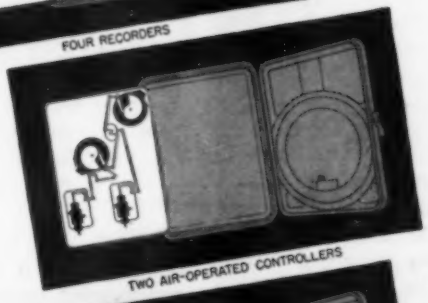
D. R. SPERRY & COMPANY, BATAVIA, ILLINOIS

Filtration Engineers for Over 50 Years

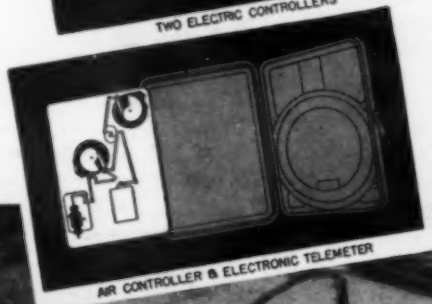
SPERRY FILTER BASES

these and 100,000 more


FOUR RECORDERS


TWO AIR-OPERATED CONTROLLERS

TWO ELECTRIC CONTROLLERS


AIR CONTROLLER & ELECTRONIC TELEMETER

FROM 4 CIRCUITS AND 8 BASIC PARTS

What's your control problem? Flow—temperature—level? Are you using solids—liquids—gases?

No matter what you process, four basic circuits and eight basic component parts will give you more than 100,000 different electronic measuring and controlling combinations. That's how Bailey has simplified controls for processing industries.

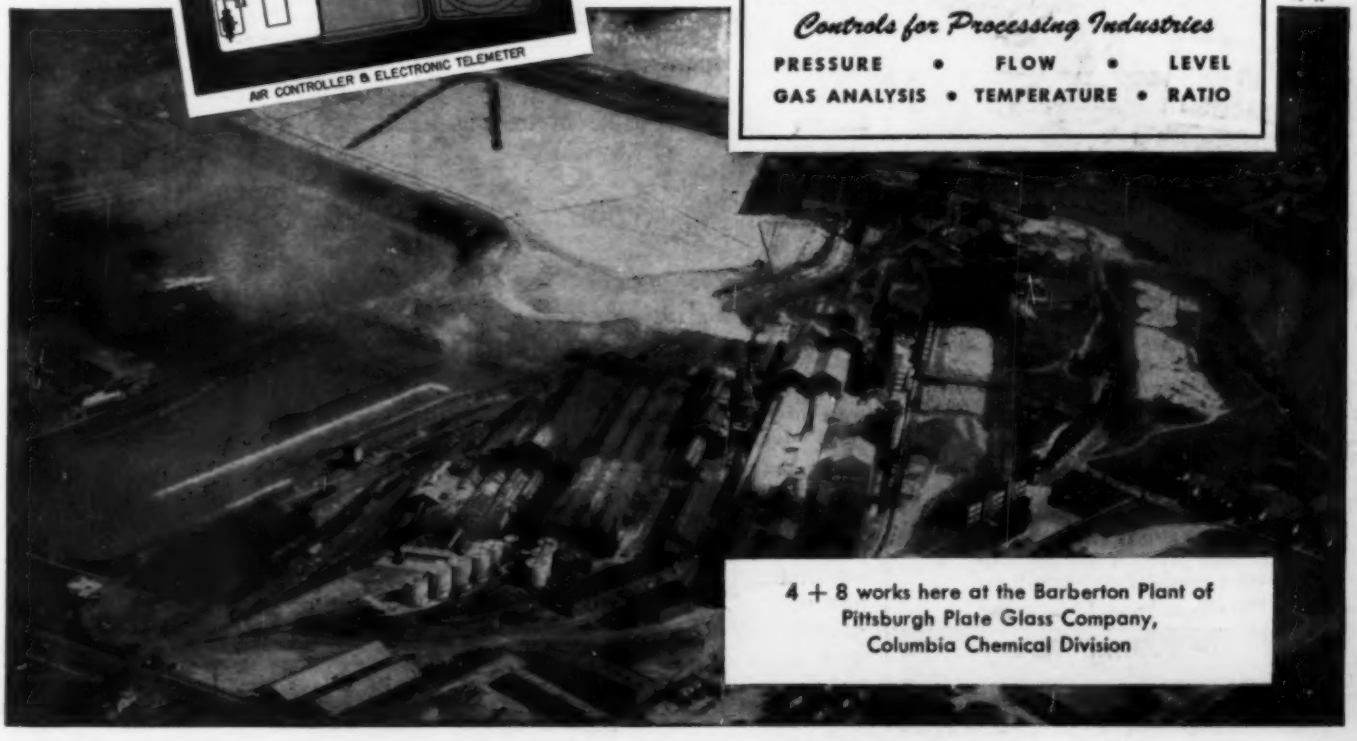
The four arrangements illustrated show how easily Bailey interchangeable parts can be used. It's no longer necessary to carry a huge stock of replacement parts for emergency control installations. When you standardize on Bailey controls you are always ready to meet changing conditions within your plant.

And with Bailey simplified controls, your maintenance costs will be less. Maintenance men quickly become familiar with Bailey controls and spend less time on maintenance and installation.

To see for yourself how you can profit with Bailey controls, write for a copy of our bulletin No. 17.

BAILEY METER CO.
1054 Ivanhoe Road • Cleveland, Ohio
BAILEY METER CO. LIMITED, MONTREAL
Controls for Processing Industries
PRESSURE • FLOW • LEVEL
GAS ANALYSIS • TEMPERATURE • RATIO

P-17



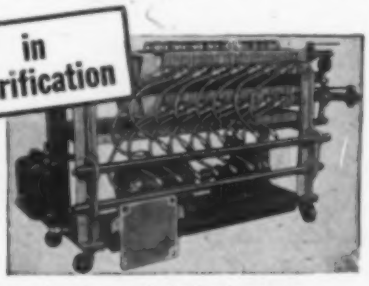
4 + 8 works here at the Barberton Plant of Pittsburgh Plate Glass Company, Columbia Chemical Division

SHRIVER
Filter Presses
are Designed for
LOWER COST
OPERATION

in Cake Recovery

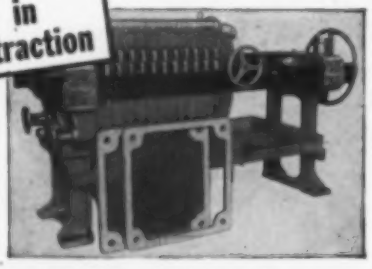
They produce filter cakes of any size, thickness and number, built up at any required pressure; firm, and dry enough to process or dry in subsequent equipment.

in Clarification



They produce in any desired volume at any flow rate, liquids of crystal clarity and purity, at any temperature or pressure, regardless of viscosity, thickness or color of slurry.

in Extraction



They produce filter cake that can be partially or thoroughly washed, steamed, extracted, leached, redissolved or melted right in the filter press.

Shriver Filter Presses are built of any material to process 1,000 gallons of slurry, for any pressure to 1,000 p.s.i., using any filter medium. Match that kind of design and performance versatility with any other kind of processing equipment, if you can.

Write for Complete Catalog
T. SHRIVER & COMPANY, Inc.

ash from one ordinary house is equivalent to adding approximately three short tons of lime and eight-tenths of a ton of potash to the soil.

Removal of trees and buildings by the bomb increased the sunlight in many areas. Soil temperatures were thus raised and the additional sunlight had a favorable effect on plant growth. The bomb also partially sterilized the soil to a depth of four to six inches. This partial sterilization may have produced a beneficial response on plant growth in releasing nutrients contained in the bodies of soil microorganisms to plant roots.

C. L. W. Swanson, Connecticut Agricultural Experimental Station, before Division of Fertilizer Chemistry, American Chemical Society, Washington, Sept. 1, 1948.

Separating the Cresol Triplets

A METHOD has been perfected for distinguishing among chemical triplets which have long caused trouble and expense for plastics manufacturers. The triplets involved are the cresols—meta, para, and ortho. They play an important part in the nation's billion-pound-a-year plastics production. They are used also in separating metals at the mine, in the refining of petroleum, and in numerous other fields.

Of the triplets, meta and para are virtually identical twins which are almost impossible to separate, while ortho is sufficiently different to be eliminated without much difficulty. When benzidine, a common chemical, is added to a mixture of meta and para cresol at a temperature a little above the boiling point of water, the benzidine and para cresol form a solid, which is separated from pure meta cresol. Since it is meta which makes the better plastics, the new process will be available in making pure meta available.

D. F. Othmer, Brooklyn Polytechnic Institute, and S. A. Savitt, M. W. Kellogg Co., before Division of Industrial and Engineering Chemistry, American Chemical Society, St. Louis, Sept. 6, 1948.

New Pain Killer

DISCOVERY of a new pain-killing drug many times more potent than cocaine has been reported. Technically, the drug is known as 1-(B-dimethylaminoethoxy)-4-butylisoquinoline, but for the sake of brevity it has been designated as SKF 538-a. It is one of a promising series of nine local anesthetics recently synthesized by a new method. Eight of the nine compounds were found to produce significant local anesthetic activity when tested on the cornea of a rabbit's eye.

While SKF 538-a is still definitely

PROMPT DELIVERY!
STAINLESS FITTINGS and VALVES
All types and sizes carried in stock

Send for Free Catalog
ALLMETAL
SCREW PRODUCTS CO., INC.
33 Greene St., New York 13

M&L *Know-How & Workmanship*
BETTER Construction means BETTER Performance . . . LONGER LIFE!

Shell and Tube Process Heater
36" Dia. – 27' – 0" Length

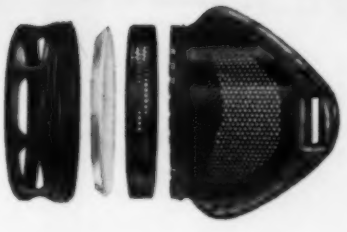
For dependable process and heat exchange equipment, custom-built to code or to your specifications, M&L is the name to remember.

Wherever you are, we're as near as your nearest mailbox. Write TODAY! We welcome your inquiries.

MANNING & LEWIS ENGINEERING CO.
DESIGNERS-FABRICATORS
40 Ogden Street • Newark 4, N. J.

Maximum Eye Protection plus a built-in "Air Conditioning System"!

AO 351A GOGGLE



Here's a goggle that gives the worker in confined, cramped quarters or hot and humid atmospheres welcome ventilation. The extension rings provide almost twice the usual ventilation area while maintaining the required strength to protect against flying particles coming from any direction. Result: lens-fogging is minimized and workers see better, feel better, work better.

Individual eyecups, low set for wide angle vision, are shaped to fit eye contours, have smooth, rounded edges and are snug against face. Bridge is insulated ball chain type, quickly adjusted. One-piece, easily adjustable rubber headband.

The 351A is particularly recommended for work near open hearth checker chambers, fire boxes and maintenance operations on oil refinery stills, etc. Fitted with 50 mm regular Super Armorplate or 6 Curve Super Armorplate clear or Calobar lenses in medium, dark or extra dark shades. Ask your AO Safety Representative or inquire at your nearest AO Branch Office.

Safety Division of American Optical COMPANY

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

ADVENTURES OF "CRIMPY"
THE BUFFALO WIRE CLOTH MAN
THIS TIME I'M MONEL
. . . you can see from my silvery-white color. Just about every industry uses me . . . for strainers, filters, sieves, vibrator screens, dipping baskets, conveyor belts. Brother, I've got friends!
I'M ONE-THIRD COPPER
. . . and ⅔ nickel. That gives me "oomph" (strong, tough and hard, to you). I'm much stronger than common brasses and bronzes.
SLICK & SMOOTH - THAT'S ME
See my glossy surface? It stays that way. I don't clog, either. Things just whiz through me.
MAYBE YOU CAN'T RESIST ME
but I'M resistant. Rust? Poof . . . I'm immune to it. Corrosion? High temperatures? Kid's stuff! Abrasion? Stress? I wear like . . . . MONEL!
IT'S A CINCH TO FORM & JOIN ME
Do I form easily? Say, I'm ductile. Any shape you like. What's more, I can be welded, brazed or soldered.
I COST LESS
than any corrosion-resisting wire cloth of equally high strength.
"Buffalo" Monel Wire Cloth is woven in a large range of meshes from very fine to coarse, in all standard weaves.
Buffalo WIRE WORKS CO., INC.
Manufacturers of All Kinds of Wire Cloth Since 1869
482 TERRACE
BUFFALO 2, N. Y.

in the experimental stage, pharmacological studies have shown it to have a pain-killing effect lasting much longer than cocaine, procaine, or dibucaine.

The drug is so strong that a dilution as low as 0.01 percent produced anesthesia in rabbits which lasted for over 3 hr. A similar solution of dibucaine produces anesthesia lasting 69 min., while 1 percent solutions of cocaine and procaine produce anesthesia lasting only 18 and 2 min., respectively.

When toxicity studies, which are now in progress, are completed, it is expected that SKF 538-a will be subjected to extended clinical trial.

J. W. Wilson, et al, before Division of Medicinal Chemistry, American Chemical Society, Washington, Aug. 31, 1948.

One of a Hundred

In the anti-smoke crusade the problem of the small offender, the householder, is the most difficult to solve. It is doubtful if this problem can ever be solved by the universal application of automatic combustion equipment. Moreover, the distribution of liquid or gaseous fuels can hardly reach such comprehensive proportions as to encompass all areas and classes of residential consumers.

Production of hard coal and ordinary coke manufactured at high temperatures cannot hope to keep up with the demand for a solid smokeless fuel, and so the changing economics and necessities of the fuel situation have opened a new and encouraging field for low-temperature coke.

Despite the existence of more than one hundred processes for making low-temperature coke, many of which received elaborate trials, the product has for years remained merely an inventor's dream. The time is only now ripe for the commercial advent of this type of fuel.

In addition to providing vast quantities of smokeless fuel from plentiful soft coal, low-temperature coking increases by as much as 400 percent the yield of coal tar, the versatile chemical raw material for thousands of every-day products.

C. E. Lesher, the Disco Co., before Division of Gas and Fuel Chemistry, American Chemical Society, St. Louis, Sept. 6, 1948.

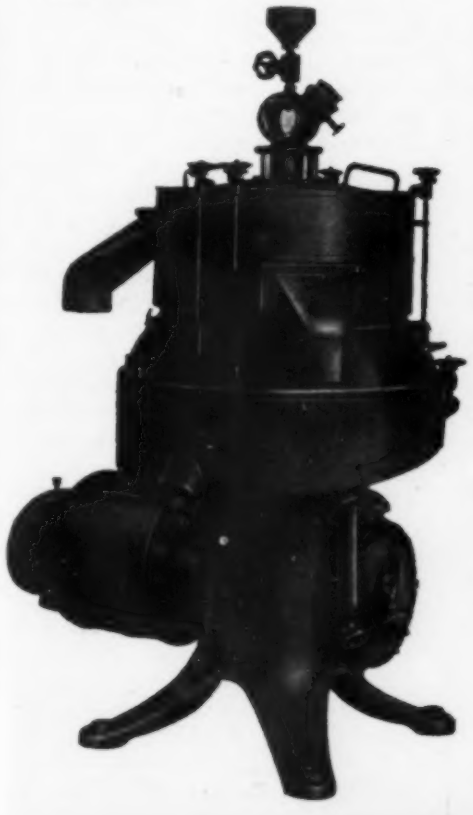
For Tanning, Fir Tannin

Large tonnages of Douglas fir bark, now chiefly a waste product, accumulate each year at lumber mills and pulp mills in the Pacific Northwest. Tannin is present in the bark in amounts ranging from 7.6 to 18.3 percent. Since the outbreak of the blight that

I PAY BIG DIVIDENDS WHEN I SPEED UP A PROCESS

Among the Many Processes SPEEDED

ACID SLUDGE • BLOOD • CAUSTIC SODA • CHICLE
CITRUS JUICES • COOKING FAT • ESSENTIAL OILS
FIRE EXTINGUISHER FLUID • FISH OIL • FORMALDEHYDE
GLUE LIQUOR • GLUTEN • IRISH MOSS • LACQUER • LATEX
LIVER OIL • OLIVE OIL • PAINT & VARNISH • PENICILLIN
PHARMACEUTICALS • PRINTING INK • PROTEINS • SERUM
STARCH • STREPTOMYCIN • TOMATO JUICE
VEGETABLE OIL • WAX • WOOL GREASE • YEAST



"I am De Laval Centrifugal Force. I have made many processes more profitable by making the separation or clarification step continuous. When centrifugal force can be used to replace slower, obsolete methods of separating two liquids, or removing solids from a liquid, I speed up operation, save labor and cut production costs.

"Can I go to work for you? It might pay to see—"

De Laval Centrifugal Force is applied through more than a dozen different types of centrifugal machines that make it possible to select exactly the right one for a given job.

From the large "Nozzle-Matic" with a separating capacity of 6,000 gallons per hour or even more, to the smallest model suitable for Laboratory or Pilot Plant work, De Laval machines completely meet the need for centrifugal machines.

A De Laval engineer will gladly look into your needs with you and see if De Laval equipment can be profitably applied to ***your*** production line.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval Centrifugal Machines

FOR PROCESSING SYSTEMS

FARQUHAR TROUGH CONVEYORS load 140 tons of ammonia sulphate per hour

A LEADING eastern railroad had to speed up handling bulk sulphate of ammonia from freight cars to freighters to meet stepped-up sailing schedules. A series of Farquhar Trough Conveyors helped solve the problem—Model 346's installed below the floor of the pier, and Model 347's (shown here) combining with bucket elevators to load an average of 140 tons per hour. At that rate, it takes less than half the time to load a freighter's hold as formerly, plus a big saving in manpower also.

Farquhar Trough Conveyors handle sharp or abrasive materials, fine or powdery materials, small bags and bundles *faster, better, cheaper*—for all kinds of plants, all types of industry. They can be fitted into materials handling set-ups that cut thousands of dollars from overhead, release manpower for other uses, speed up the entire operation. Come in all sizes and mountings for all requirements.

No matter what you move, stack, pile or load—see Farquhar first for the *right* materials handling conveyor for your job—whether for portable, semi-permanent or permanent use. Tell us your problem—we're ready to help.

For complete information, write: A. B. Farquhar Company, Conveyor Division, 219 Duke St., York, Pa., or 616-A W. Elm St., Chicago 10, Ill.

Farquhar
PORTABLE OR PERMANENT MATERIALS HANDLING
CONVEYORS

HYDRAULIC PRESSES • FARM EQUIPMENT • FOOD PROCESSING AND SPECIAL MACHINERY

has decimated the chestnut tree, formerly used in leather making, the United States has been forced to import about two-thirds of its annual requirements of tannin, which is employed to convert hides into leather. Hence it is desirable that domestic sources of tannin be developed.

The tannin is present in Douglas fir bark in amounts that make it feasible for commercial extraction. Heavy leather made from the bark liquor in a commercial tannery is soft and pliable, and has an even, light color.

The amount of tannin in the bark varies with the age of the tree and with the height at which the bark grows. For example, the tannin content of bark taken from the bottom of trees 110 to 250 years old was 7.6 percent, whereas the bark from top logs of trees 50 to 80 years old was 18.3 percent tannin.

James Hubbard, E. F. Kurth and Harry Kiefer, Oregon Forest Products Laboratory, before Division of Agricultural and Food Chemistry, American Chemical Society, Portland, Sept. 14, 1948.

Costs of Fuel From Coal

BITUMINOUS and sub-bituminous coal can be easily converted into an oil which may be readily burned in existing equipment. The Bureau of Mines has made a study of the possible methods, and has selected two for comparative purposes. They are direct hydrogenation and a combination of hydrogenation and extraction. The make-up hydrogen is produced either by gasification of coal or by low temperature separation from coke oven gas.

In the direct hydrogenation method, pulverized coal is liquefied in the presence of an excess of hydrogen at approximately 900 deg. F. and 700 atm. pressure. The products of the reaction are distilled in conventional equipment to remove the low boiling components in order to make a finished product.

The hydrogenation step in the combination process is essentially the same as in direct hydrogenation. The principal difference is that the main product is a middle oil having a 635 deg. F. EBP, which is used as the solvent in the extraction step. Pulverized coal and solvent are heated to about 800 deg. F. under a pressure of 150 atm. for 1-1½ hr. The extract is filtered to remove the solids and undissolved coal. The low boiling components and part of the solvent are separated by distillation.

Gasoline, liquefied petroleum gases, and phenols are obtained by byproducts in both processes.

The capital investment for a plant to produce 10,000 bbl. per day by each

June Weather at Trappers Lake, Colorado

What! ENJOY JUNE COMFORT ALL WINTER LONG?

This is the best way we know to picture the warm, comfortable weather you'll have in your plant after you've installed American Blower Unit Heaters.

These dependable, space-saving unit heaters wipe out cold spots . . . put heat where you want, in the quantity you want and provide comfortable working conditions.

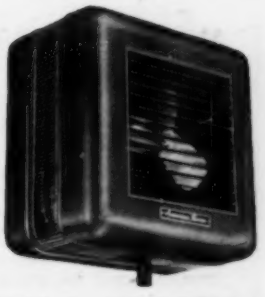
And only in American Blower Unit Heaters do you find *all* these advantages: (1) Coils made of Admiralty Tubing; (2) More comfortable final temperatures; (3) Better heat diffusion; (4) Lower power consumption; (5) Quieter, more dependable performance, with fans and motors completely enclosed in heater housings.

American Blower Unit Heaters are carried in stock in principal cities by the leading Plumbing and Heating Supply Houses. Ask your Heating Contractor or call your nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

New Vertical Unit Heater



New Venturafin Unit Heater

AMERICAN BLOWER

Serving home and industry

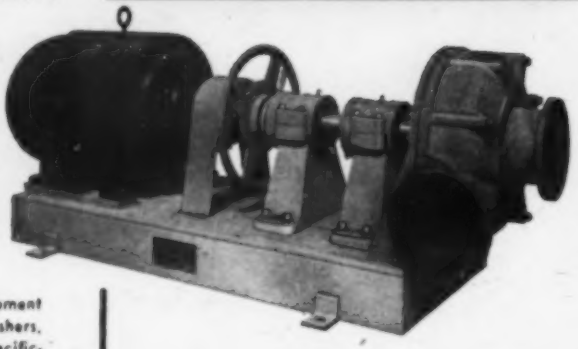
AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON

ROBINSON

"UNIQUE" PROCESSING EQUIPMENT

ATTRITION MILLS

Your Solution to Unusual Grinding Problems



WRITE US YOUR NEEDS

To improve upon or further develop your processing operations, you should be posted and acquainted with the advanced features incorporated in "Unique" Equipment (Mixers, Mills, Cutters, Crushers, Sifters). Designed and built specifically to meet your requirements, these units save as they serve!

Thousands in use grinding all types of material. Adjustable for coarse or fine grinds. Hard iron grinding plates. Capacities to your requirements. Robinson Equipment is designed by engineers whose reputation is founded upon doing things right. Send for literature.

UNIQUE

ROBINSON MANUFACTURING CO.

Exclusively Represented By

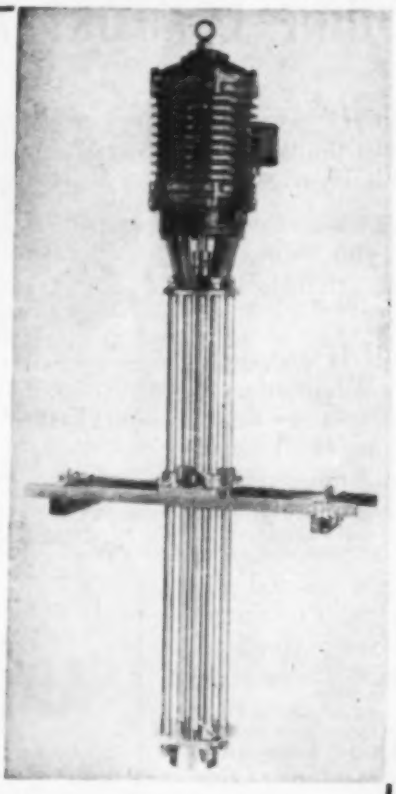
MERCER-ROBINSON COMPANY, INC.

30 CHURCH STREET, NEW YORK 7, N. Y.

Sales Offices in Principal Cities

HOMO-MIXER

A Mixer for Solving your Processing Problems



The Homo-Mixer reduces particle size—increases total surface area—shortens batch cycles.

An efficient emulsifier and disperser—easily sterilized and cleansed.

Mixes in vertical planes—prevents stratification and dead spots—minimizes surface boil and incorporation of air.

Available in laboratory, pilot plant and production sizes.

Designed to fit your tank or kettle—or furnished with single shell, steam jacketed, electrically heated, oil bath or tilting type kettles.

Vacuum and air tight installations quoted upon request.

Write for a copy of Catalog No. 402

EPPENBACH, INC. 45-10 Vernon Blvd. Long Island City 1, N. Y.

process has been estimated, with hydrogen obtained by coal gasification and by separation from coke oven gas.

Estimated material quantities and operating costs have been computed. They indicate that the cost of producing a fuel oil suitable for industrial use from coal is not much more than the prices paid for petroleum residual fuel oils during the past year. Such plants will be economically practical in the near future, if the present trend of prices for petroleum residual oils continue.

L. C. Skinner, et al, Office of Synthetic Liquid Fuels, before Division of Gas and Fuel Chemistry, American Chemical Society, St. Louis, Sept. 7, 1948.

Micronutrients

PLANTS, like people, need a wide variety of foods, and unless more American farmers realize this fact widespread crop failures may soon imperil the nation's economy.

Too many farmers at present are so anxious to obtain high yields that they are employing more and more fertilizer staples—nitrogen, phosphorus, and potassium—without adequate regard for the average plant's craving for such tasty dietary supplements as manganese, copper, boron, and zinc. Because high crop yields remove more natural plant foods from the soil than do low yields, the inevitable result of this intensive farming will be crop losses due to diet deficiencies, unless proper corrective measures are taken.

Soil chemists, agronomists, and horticulturists today generally agree that we have a secondary and micronutrient problem in the fertilization of crops. They do not agree on how widespread it is, or on how best to handle it. Most will probably agree that the problem will be more widespread in the future than it is today.

There seem to be three schools of thought as to how this program can best be handled. The first is to make the various materials available but not to incorporate them in the regular grades of fertilizers. This means that where manganese, copper, boron, or zinc may be needed an extra trip over the land by the farmer is necessary for their application.

The second method is the general addition of a dose of a "shot gun" mixture. From a manufacturer's standpoint this procedure has some merit providing farmers will pay the premium. This eliminates the extra grade problem.

The third method is that of making certain regular grades available with sufficient quantities of micro and secondary nutrients to really do some good and in guaranteed amounts. This

Accept no less than the FULL LINE!

Whatever the conditions: Extreme temperatures . . . . extreme pressures . . . . steady flow or shock service . . . . corrosion resistance . . . . product purity.

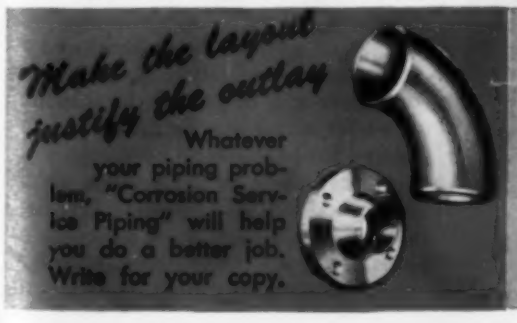
Whatever the material: Forged carbon steel . . . . wrought iron . . . . carbon or chrome moly . . . . Stainless 304, 347, 316 . . . . Monel . . . . Nickel . . . . Inconel . . . . Aluminum . . . . other usual industrial materials.

Whatever the size or weight: Forge-formed fittings in the entire size range from ¾" all the way to 30" (or larger!): in all the usual or special weights necessary for *any* service condition; with a companion range of seamless forged and forge-rolled flanges of every type, in *all* ASA sizes and pressure series, or beyond, as large as 96" diameter.

Whatever your requirement: Taylor Forge provides the most complete line. Accept no less!

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS General Offices & Works: Chicago 90, Ill. (P.O. Box 485) Eastern Plant: Carnegie, Pa. Western Plant: Fontana, Calif. • District Offices—New York: 50 Church Street • Philadelphia: Broad Street Station Bldg. • Pittsburgh: First National Bank Bldg. • Chicago District Sales: 208 S. LaSalle Street • Houston: City National Bank Bldg. • Los Angeles: Subway Terminal Bldg.


Make the layout justify the outlay
Whatever your piping problem, "Corrosion Service Piping" will help you do a better job. Write for your copy.

Send me "Corrosion Service Piping"

Name_____

Position_____

Company_____

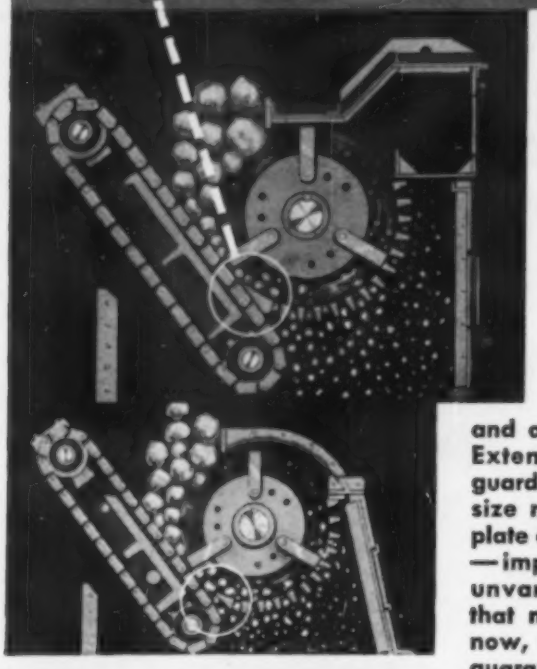
Street Address_____

City_____ Zone_____ State_____

513-114

Mail to Taylor Forge & Pipe Works
P. O. Box 485, Chicago 90, Illinois

BETTER CRUSHING BEGINS HERE!



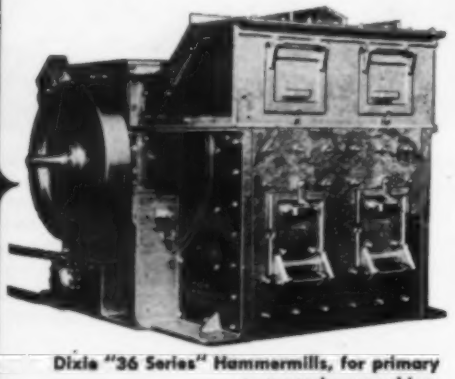
Crushing money is saved or squandered in the "heart" of the mill...where reduction begins! That's why the headline feature of the new improved "36 Series" Dixie Hammermill is the extension of Dixie's Continuously Moving Breaker Plate*... a unique, money-saving innovation that sets a new standard of crushing efficiency.

Note by comparing before and after diagrams how the new, Extended Moving Breaker Plate guards against the passage of oversize material between the breaker plate and front cage bar. The result —improved grinding control for unvarying uniformity of product that makes the Dixie Hammermill now, more than ever before, your guarantee of greater production at less cost.

NEW! IMPROVED! DIXIE HAMMERMILL

Other important changes in the new "36 Series" Dixie Hammermill include:

- 1. All-steel construction for greater strength . . . longer life
- 2. Flange type end discs of all cast steel for protection of hammer bolts and nuts from wear at ends
- 3. Convenient clean-out and inspection door
- 4. Metal trap (optional) for facilitating removal of tramp iron.



Dixie "36 Series" Hammermills, for primary or secondary crushing, are built in 4 sizes in capacities ranging from 25 to 150 tons.

*U. S. Patents Granted and Pending

DIXIE MACHINERY MFG. CO.

MAIN OFFICE & PLANT
4172 GOODFELLOW AVE., ST. LOUIS 20, MO.
FOREIGN OFFICE: 104 PEARL ST., NEW YORK, N.Y.

WRITE TODAY FOR COMPLETE DETAILS!

is the preferable way to handle the bulk of the problem.

Such a program protects the farmer and insures the industry that there will be a sufficient tonnage of such grades so that they can be manufactured and distributed economically. From the manufacturer's standpoint it means extra grades. Every grade added, of course, complicates the manufacturing program to some extent. Definite recommendation, backed by adequate research, will help to keep the number of grades within reason.

G. H. Serviss, Cooperative G.L.F. Exchange, before Division of Fertilizer Chemistry, American Chemical Society, Washington, Sept. 1, 1948.

Unreasonable and Uneconomical

THE CURRENT boom in pollution control activities has brought many people and groups into the field who are novices in sanitary engineering problems. We have at one extreme strong pressure groups interested in sports and wild life who appear to believe that pollution can be completely abated, and at the other extreme some manufacturers who are fighting to maintain the unhampered use of public water for the disposal of their wastes. The great diversity of interests represented by these newcomers and the lack of understanding on the part of many of them of the technical nature of the problems to be solved are producing a crazy quilt of pollution abatement policy. It behooves us to take stock of this situation now and to work for sane and sound policies throughout the nation. If we fail to develop economic, equitable and effective policies, the whole program may bog down through unwise and wasteful expenditures.

It is wrong to require more treatment than is required to produce the desired results, and it is wrong to require any polluter to treat his wastes or sewage unless such treatment is required to produce the desired results at the least over-all cost. The problem of pollution abatement for a particular water course should be studied as a whole so as to determine which wastes must be treated and which may be allowed to go untreated for the best economical solution. Water pollution control policies should be so developed as to permit the selection of wastes for treatment and to permit the selection of wastes which may be discharged untreated for best over-all economy. This is contradictory to the policies which have been followed by some agencies. Under existing law it is easier for a public agency to enforce a policy which requires treatment by all pollut-

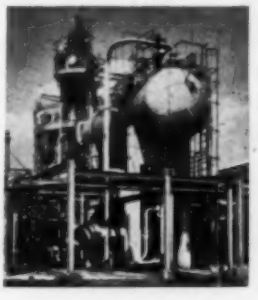
COMMERCIAL-SCALE

SOLEXOL*

PLANTS ARE NOW OPERATING!

THIS new method for the processing of tallows and marine oils, introduced to industry just two short years ago, is now a commercial reality—two plants operating, another to go on stream within weeks, with others in the design and construction stages.

Processors of marine and animal fats and oils should find it advantageous to examine the economics of this process which operates on a purely physical principle—separating, refining and concentrating various fractions without loss or deterioration by thermal or chemical reaction.



Pilot plant data may be had by writing to the Glyceride Processes Division, The M. W. Kellogg Company, 225 Broadway, New York 17, New York.

*Licensed jointly by The M. W. Kellogg Co. and The Chemical Foundation, Inc.

GLYCERIDE PROCESSES DIVISION

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN, INC.

ENGINEERS TO THE PETROLEUM INDUSTRY

© 1948, M. W. Kellogg Co., New York

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

New! TERRISS 3-SPEED
PORTABLE MIXER
STIRS • BLENDS
MIXES • AGITATES

No more carrying heavy mixer . . . clamping to tanks . . . breaking side walls

The New TERRISS 3-speed Portable Mixer is an all-around unit that will take care of all your mixing, blending and agitating problems. If your tank or vat is below floor level the TERRISS 3-speed Mixer will reach down and do a real job for you. If your container sits on the floor, a little adjustment and the mixing begins. If your tank or container is high off the floor, the TERRISS Mixer will lift up and do the mixing job. All parts that touch your product are Stainless Steel. Standard belt drive permits propeller speeds of 175 RPM, 325 RPM and 575 RPM. Other combinations are available with simple adjustments. Both propeller shaft and stand are adjustable, permitting unlimited settings to fit any job in your plant.

Send your order today . . . money-back guarantee

TERRISS
. . . DIVISION OF Consolidated Siphon Supply Co., Inc.
MANUFACTURERS SUPPLYING THE PROCESSING INDUSTRIES
Dept. C, 22-24 Wooster New York 13, N. Y.

NEW
CATALOG AND DATA BOOK
ON SAFETY and RELIEF VALVES
For Chemical & Refining Industries

72 Pages *Over 26 pages of Factual Data*

* * *

Comparison, Selection and Sizing Charts

* * *

The New Farriseal Bellows

All the information needed for installation and operation of Safety or Relief Valves

Sent only to Engineers and Executives.

Name..... Position.....
Company.....
Street.....
City.....Zone....State.....
(Attach coupon to your business letterhead)

FARRIS ENGINEERING CORPORATION
404 Commercial Avenue, Palisades Park, New Jersey
Manufacturers of Safety, Relief & Pinch Valves

ers on a given water course, and the same degree of treatment for similar wastes. This is an unreasonable policy. It is uneconomical and dangerous to the over-all program of pollution abatement.

Except in cases where the agency is charged with the design and operation of the treatment process, the public agency should leave the details of design and operation to the polluter. Each polluter should be allocated by the control agency a definite quantity of polluting substances not to be exceeded at each point of pollution. The means by which the required degree of treatment is accomplished should be left to the ingenuity of the polluter. It is wrong to require standard methods of treatment if the polluter can show that he can produce the required quality of effluent by other means which he considers less expensive and more appropriate for his use.

Thomas R. Camp, consulting engineer, before American Society of Civil Engineers, Boston, Oct. 14, 1948.

Methoxychlor

A POWERFUL new insecticide called methoxychlor, is the least toxic of the several chlorinated compounds used for the control of insect pests, and promises to become a major contribution to agriculture, human welfare, and comfort.

Milk from dairy cows which have been treated with methoxychlor contains none of the chemical, and extensive tests have shown that it is not absorbed fast enough through the skin of animals to have harmful effects.

In the agricultural field, vegetable crops, such as snap and lima beans, cabbage, squash, cucumbers, melons, and peas head the list of those on which methoxychlor may be useful. Its use on fruit crops, such as peaches, early apples, bramble fruits and grapes holds great promise. It is especially promising for use on those crops where residue hazards may be involved.

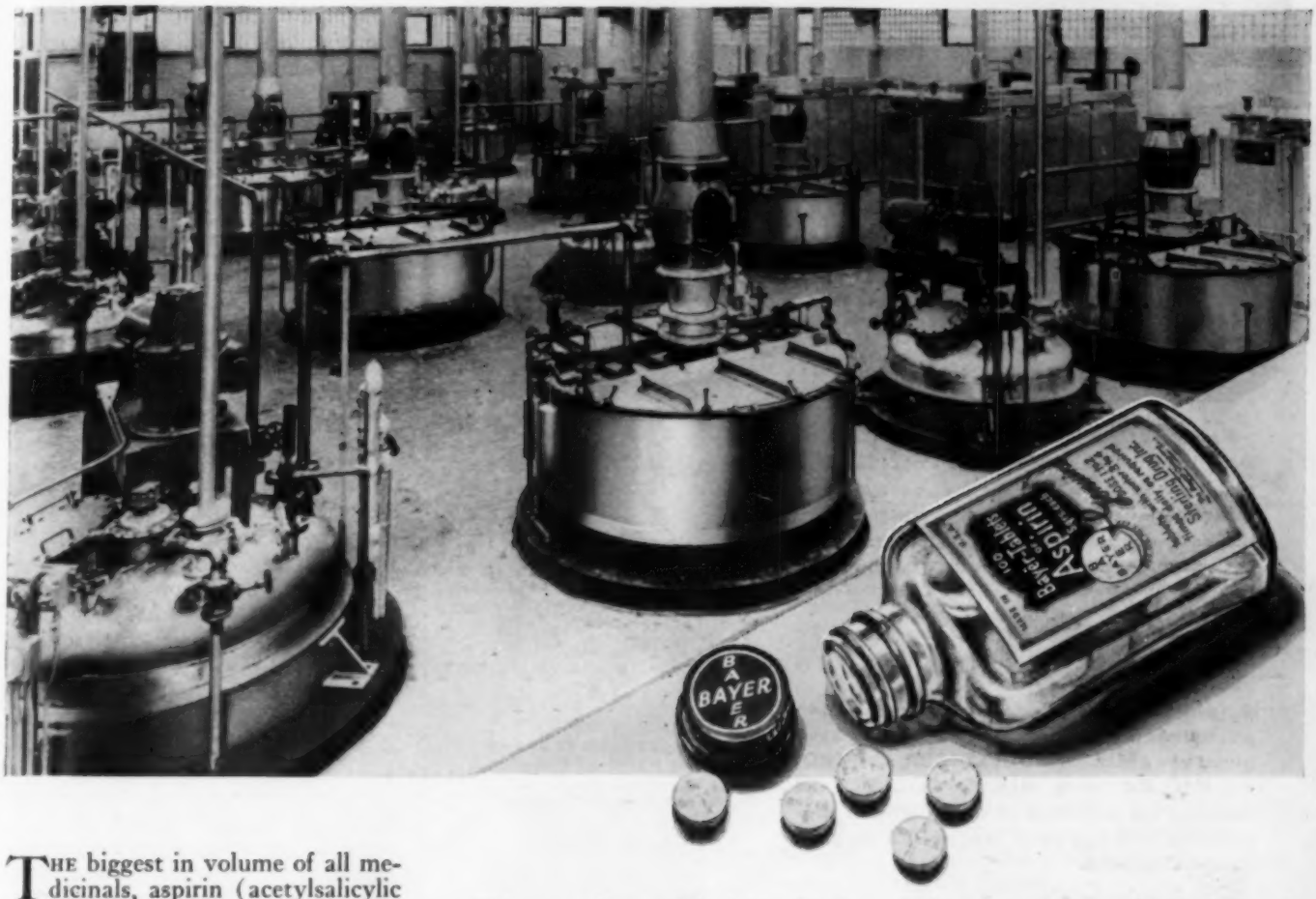
Methoxychlor, which is known technically as 2,2-bis-(p-methoxyphenyl)-1,1,1-trichloroethane, possesses long-lasting qualities and fast knockdown action against several kinds of flies and other pests.

Various studies of the effect of methoxychlor on warm-blooded animals and of the relative toxicity of many of the newer chlorinated insecticides all showed that it is the least toxic of those commonly used. It can be used with practically no risk to animals, both with respect to acute toxicity and the effect of repeated ingestion of small amounts such as would be found in residues on treated crops.

For use as an insecticide in the agricultural and household fields, meth-

Stainless Steel equipment

takes the headaches out of aspirin processing



THE biggest in volume of all medicinals, aspirin (acetylsalicylic acid) pioneered 50 years ago by the Bayer Co., is now produced in a new plant at Trenton, N.J. which embodies every possible feature to insure purity, uniformity and potency.

Because here quality control is of utmost importance, materials of construction throughout are predominantly of Stainless Steel. In fact, every piece of equipment that comes in contact with the aspirin product —including reactors, filters, pumps, piping, and even the granulating equipment—is made of Stainless to minimize possible contamination.

This over-all use of Stainless Steel by Bayer is typical of the trend throughout the chemical process industries. Not only to insure better quality control but to meet the rising costs of labor and materials, operations are being increasingly mechanized and streamlined, mechanical aids of all kinds are employed, and Stainless Steel is being used in more places and in greater quantities than ever before.

In U·S·S Stainless we offer you a complete line of perfected Stainless Steels—steels which in every field of engineering chemistry have proved their ability to safeguard quality and speed up processing, to increase output and to lower production costs.

Our Stainless engineers are specialists in the use of these superior steels. Ask for their cooperation if you plan to rebuild or modernize. You'll find their suggestions practical and extremely helpful not only in determining what grade of U·S·S Stainless will do the best job for you, but in showing how it can be most efficiently handled in the fabricating shop.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO · CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO · NATIONAL TUBE COMPANY, PITTSBURGH · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

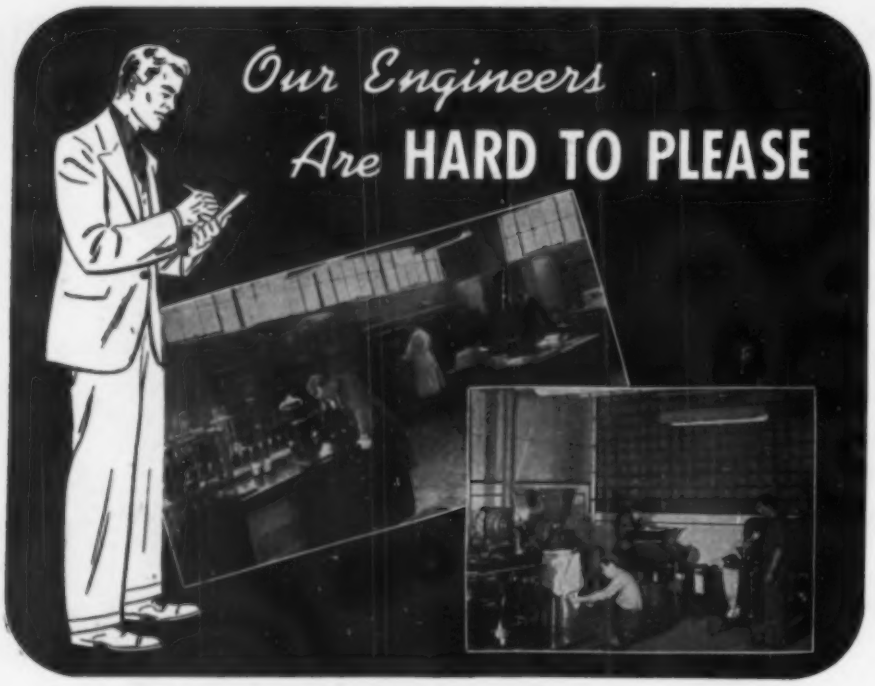
USS

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

8-1608

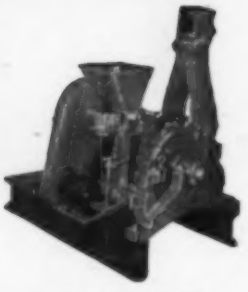
UNITED STATES STEEL



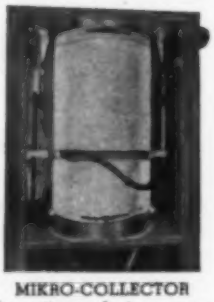
From start to finish .... from basic laboratory research to the smooth functioning of a machine fashioned specifically for your individual needs .... our technicians work tirelessly to lick your pulverizing and dust collection problems and to see that they stay licked.

They are steeped in a tradition nurtured by a quarter century of service which rejects the phrase "good enough." They are schooled in the philosophy of constructive dissatisfaction .... trained never to "let go" until they have given you a MIKRO-PULVERIZER, a MIKRO-ATOMIZER, or a MIKRO-COLLECTOR insuring the last word in the quality of your product and the very last pound in your potential volume.

Or, they will tell you frankly if their preliminary studies, checked against the data gleaned from 55,000 tests already made in our Laboratory, prove that our equipment is not adaptable to your use. They are never permitted to forget that our company built its worldwide reputation on the intensely practical consideration that its own profits will always ascend to the level of its ability to increase yours.



MIKRO-ATOMIZER
for grinding to 2 to 25 microns



MIKRO-COLLECTOR
for optimum dust recovery

MIKRO-PULVERIZER
for pulverizing to 325 mesh

25 YEARS SERVING INDUSTRY

It costs you nothing to sample the thoroughness of these efforts in your behalf. Simply send today for your copy of our Confidential Test Grinding Data Sheet.

PULVERIZING MACHINERY COMPANY
55 CHATHAM ROAD • SUMMIT, NEW JERSEY

MIKRO-PULVERIZER (FINE)
MIKRO-ATOMIZER (ULTRA FINE)
Reg. U. S. Pat. Off.
Also Makers of the MIKRO-COLLECTOR

oxychlor can be readily formulated as dilute dusts, wettable powders, liquid oil concentrates, oil emulsifiable concentrates and aerosols. It is insoluble in water, acids, and alkalis. Methoxychlor is remarkably resistant to oxidation, and upon indoor exposure it will remain unchanged almost indefinitely.

It is compatible with most common insecticides and such fungicides as wettable or dusting sulphurs, Bordeaux mixture, the "fixed" copper compounds, and the newer organic fungicides.

While methoxychlor is a comparative newcomer among the highly effective, chlorinated insecticides, its unique combination of favorable properties indicates it will become a major contribution to agriculture, human safety, and comfort.

C. J. Krister, E. I. du Pont de Nemours & Co., before American Chemical Society, Washington Aug. 30, 1948.

New Process Retains Sugar Vitamins

THE COST of refining sugar can be greatly reduced by a new process which also salvages the vitamins now largely wasted.

A "very light yellow sugar as pure as that presently sold" has been manufactured on an experimental scale by the new technique, in which contaminants are washed out from the raw sugar with wood alcohol.

The American public uses 15,000,000,000 lb. of sugar a year, a hundred pounds for every person in the United States. All of the impurities, including some valuable vitamins, are entirely wasted.

By as simple a device as a bath in wood alcohol, 95 percent of this raw sugar can now be refined to give a product of 99.7 percent purity.

The expensive melting of the sugar, purification over char produced from animal bones, evaporation, recrystallization and many other steps are all eliminated in this simple process which will operate at a fraction of the cost of present huge plants.

This new process not only makes pure sugar, but also saves all of the vitamins which are present in the raw sugar and are now laboriously and expensively refined out of it. These valuable constituents are obtained in a residual molasses of pleasant flavor which, because of the high vitamin content, would be particularly valuable for direct human food use.

Furthermore, the process will make practical the direct production of sugar, practically 100 percent pure and white, at the point of origin, without the expensive shipment of raw sugar and without a set-up of complete re-

Only AJAX

LO-VEYORS

GIVE YOU ALL THESE COST-CUTTING FEATURES

The exclusive Ajax design principles are responsible for the low maintenance cost and, in turn, low material handling costs.

1. 3 basic parts—the pan or tube . . . the vibrating or shaking mechanism . . . the motor, variable speed drive or other source of power to drive the shaker.
2. Completely self-contained, ready to use.
3. Completely enclosed drive unit with only 2 working parts.
4. Conveyor pan supported by flat springs mounted in rubber bushings,—no exposed bearings, no eccentric shafts, idler and tail pulleys.
5. Pan or tube can be made of ferrous or non-ferrous metal and can be lined or coated for protection against contamination.
6. Pans available with or without covers.
7. Tubular conveyors provide gas-tight construction for critical process and explosive operations.

Write giving outline and sketch of your requirements for handling dry aggregates

AJAX FLEXIBLE COUPLING CO. INC.

CONVEYOR AND SCREEN DIVISION • WESTFIELD, N. Y.

"LIQUIDS WORTH STORING ARE WORTH MEASURING"
with a
LIQUIDOMETER
Tank Gauge
• FOR GAUGING LIQUIDS OF ALL KINDS
• 100% AUTOMATIC
• APPROVED BY UNDERWRITERS' LABORATORIES

THE LIQUIDOMETER CORP.
36-29 SKILLMAN AVE., LONG ISLAND CITY, L.N.Y.

What will YOU have from the complete VIKING LINE of ROTARY PUMPS?
Viking is a specialist in Rotary Pumps of sizes from ⅔ to 1050 gpm, pressures to 200 psi—500 psi on hydraulic oils. Send for free bulletin 47SMM today!

Samples of VIKING ROTARY PUMPS
See Our Catalog In SWEETS
Viking PUMP COMPANY
Cedar Falls, Iowa

working, remelting, and refinery operations in those places where they do not already exist.

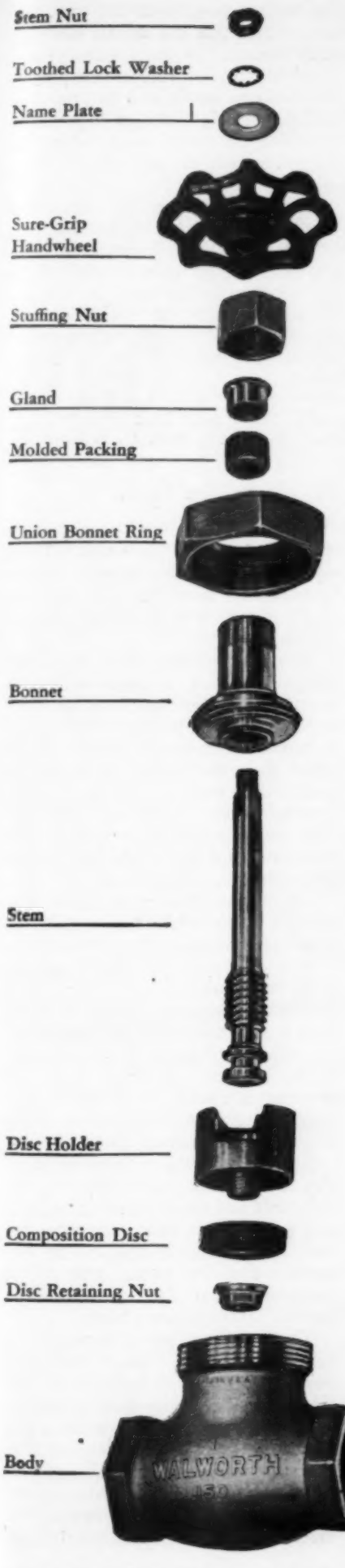
A. H. Luley and D. F. Othmer, Brooklyn Polytechnic Institute, before Division of Industrial and Engineering Chemistry, American Chemical Society, St. Louis, Sept. 8, 1948.

Polyelectrolytes

POLYELECTROLYTES are substances of high molecular weight, which are simultaneously electrolytes. Synthetic materials of high molecular weight have become fairly familiar to the general public. A number of naturally occurring substances such as proteins and polysaccharides are known to have high molecular weight and are electrolytes as well. Their structure is rather complicated, and has not yet been fully investigated. Furthermore, their electrical and hydrodynamic properties are quite unlike those of simple electrolytes. Now the properties of electrically neutral polymers and of simple electrolytes are well understood, in the sense that we have a molecular model which can be used to predict their properties in terms of fundamental parameters. It therefore seemed logical to synthesize linear polymers of known structure, convert these to electrolytes, and then study the properties of the products. In this way, we may obtain at least an empirical correlation between structure and properties, and eventually by analogy draw some conclusions concerning the biologically important natural polyelectrolytes.

Just as synthetic rubbers can be made which have properties not shared by natural rubber, we can make polyelectrolytes unlike those which appear in nature; in other words, we can start with rather simple structures, and gradually increase their complexity.

Vinylpyridine is a substance much like styrene with the significant difference that it contains a pyridine ring instead of a benzene ring. The vinyl group still will build the monomer into long chains, exactly as with styrene. After polymerization, the neutral nitrogen atoms in the pyridine rings in the polymer are converted into ionic nitrogens by the addition of alkyl halides such as butyl bromide. In this way, a long-chain strong electrolyte is obtained. By copolymerizing the vinylpyridine with styrene, other electrolytes with different (but known) distributions of charges can be made. Other methods of making synthetic polyelectrolytes have also been developed. The conductance and viscosities of solutions of these compounds at different concentrations and in different solvents have been measured. The conductance data give a measure of



TO MAKE A GOOD VALVE BETTER

Walworth has redesigned and improved its No. 95 Quality Bronze Globe Valve.

150 pounds working steam pressure at 500F

300 pounds cold water, oil, or gas.

Can be repacked under pressure when fully opened.

The Walworth No. 95 Bronze Globe Valve has always been tops with piping men because they liked these features: Renewable composition disc; lock-on, slip-off disc holder; union bonnet construction; deep stuffing box; tough bronze body made of Composition M (ASTM B61).

Now Walworth has added these improvements: (1) New cylindrical disc holder that accurately guides the disc to the seat, regardless of the position in which you install the valve. (2) Newly designed, air-cooled, sure-grip handwheel that you can grab and turn, even when wearing greasy work gloves. It has a tapered square hole sized to gage to fit snugly on the finished square of the stem. (3) Toothed lock-washer to prevent the stem nut from becoming loose. (4) All parts have been redesigned to give maximum service and strength.

Walworth Quality Bronze Valves are available in Globe (No. 95), Angle (No. 96), or Check (No. 97) types and in sizes from ¼ to 3 inches (check valves ¼ to 2 inches). Ask your Walworth distributor to show you the improved Walworth No. 95 Bronze Valve, or write for further details.

WALWORTH

valves and fittings

60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Condenser Cuts Refrigeration Costs Saves Cooling Water

● The Niagara Aeropass Condenser cuts the cost of refrigeration by running compressors at lower head pressure, saving up to 35% of power. It uses no cooling water.

The refrigerant gas passes thru two coils in an air stream. The first, "Duo-Pass" dry coil, removes the super heat by air cooling and condenses oil vapor. The second, condensing coil, drenched by recirculated water spray, condenses by evaporation, transferring to the air 1,000 BTU for every pound of water evaporated. This done at low temperature, no scale forms on condenser tubes to clog air passage.

Between the two coils is the "Oilout", which purges the system of crankcase oil and dirt, keeps it always at full capacity.

The "Balanced Wet Bulb" control holds head pressure at the practical minimum. It automatically proportions the fresh air stream to the condensing load with the full benefit of power-saving on cool days, providing full capacity for peak loads.

Niagara Aeropass design results from over fifteen years' experience condensing by air. It is completely trustworthy for year 'round operation. Users say, "It saves half the difficulties and labor of running a refrigeration plant."

Units range from 10 to 100 tons capacity. For full information ask for Bulletin 103.

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. CM, 405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

the relative number of free ions, and have shown that the intense electrical fields produced by concentrating many ions into the small volume occupied by the chain molecule lead to properties which resemble those of highly concentrated solutions, even when the polyelectrolyte is present in dilute solution.

Similarities between the behavior of proteins and polysaccharides and that of the synthetic polyelectrolytes suggest that a better understanding of the biological materials may be attained through a study of the synthetics, thanks to the controllable variability which the latter offer to the experimenter.

Raymond M. Fuoss, before American Association for the Advancement of Science, Washington, Sept. 14, 1948.

Suicide on the Farm

IT'S NOT the protective spray alone which kills fungi on crops. These microscopic parasites commit suicide by poisoning themselves. This is one of the theories on the mechanism of fungicides.

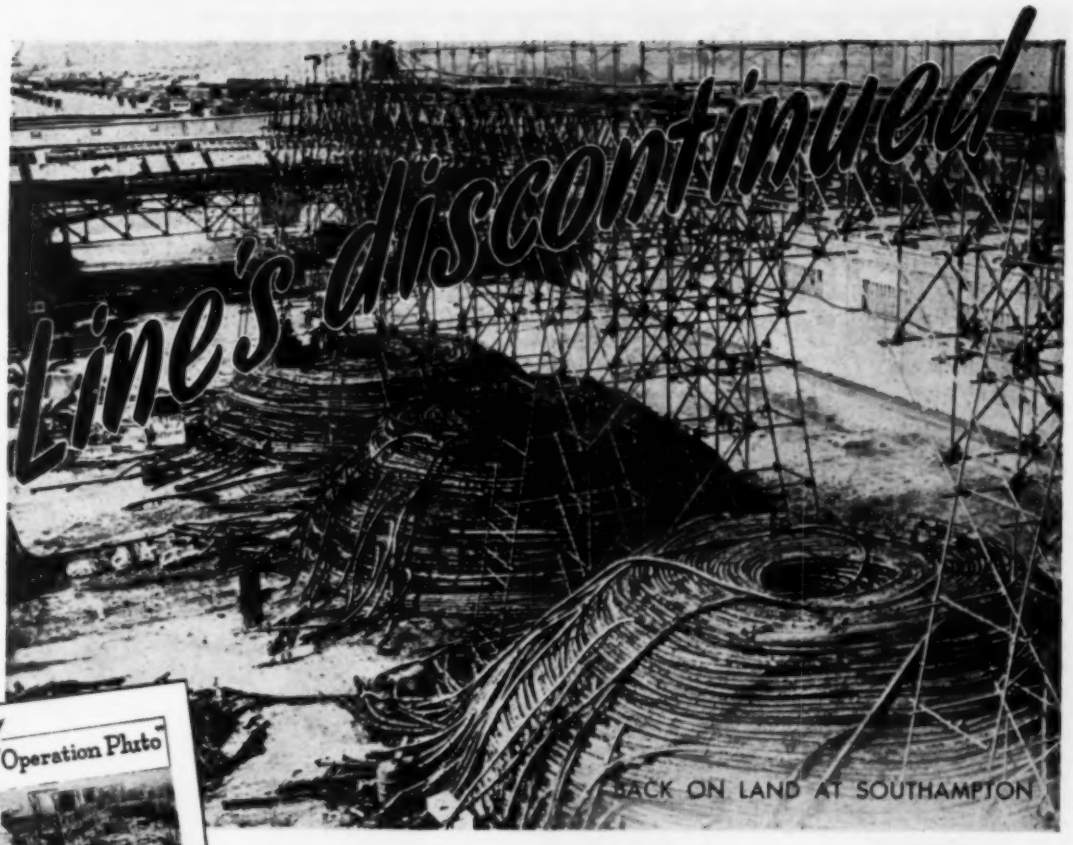
In most cases fungicides are applied to healthy plants and seeds to protect them from possible infection by fungi or fungus spores, because once a plant is infected there is usually no control other than to destroy the infected part. Also, these fungicides have to withstand the weathering action of rain and wind, and they must not burn or injure the plant. Hence they are applied in a water-insoluble form. The question thus arises as to how such relatively insoluble materials can exert their protective fungicidal action.

The outstanding copper fungicide is Bordeaux mixture, which is prepared by mixing a solution of copper sulphate with a suspension of lime. However, the copper mysteriously "disappears" in the solution. It would seem that the fungus spores bring the copper into the solution by their own secretions and thus poison themselves.

There was much controversy about this in past years but recent work has demonstrated the presence of hydroxy and amino acids which can form soluble toxic copper complexes. It thus appears that the main agent is the secretions from the fungus supplemented by the action of rain.

The suicide theory also applies to sulphur fungicides. The eventual deposit of this type of fungicide is considered to be finely divided sulphur particles. This sulphur has been said to act in an oxidized form such as sulphur dioxide, or pentathionic acid or as hydrogen sulphide. More recent studies do not in general support the theory of oxidization products. Instead,

The Line's discontinued



and "PLUTO" is now "PIER"

(Pipe Lines Under the Ocean) *(Plumbing in English Residences)*

The amazing story of "Operation Pluto" furnished the theme for the advertisement reproduced here in miniature; it appeared in the trade press shortly after a relaxation in security measures made its publication permissible.

The 75 miles of three-inch lead pipe shown above are from one of the four 100-mile lines laid from the Isle of Wight to Cherbourg. Operation Pluto carried an average of a million gallons of oil a day to Allied troops in France. Each mile of the steel-armored lead pipe weighed 63 tons. The "Plumber & Journal of Heating," London, estimates that the British Government will reclaim about 10,000 tons of lead from these pipe lines—enough to provide plumbing for 50,000 new workers' homes.

Since lead is practically indestructible, the reclamation and use of secondary lead plays a vital part in U. S. economy. According to the U. S. Bureau of Mines, U. S. industry consumed 1,150,000 tons of lead in 1947. Of this total, about 44%, or 504,000 tons of lead were reclaimed from scrap—an all-time high.

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE • NEW YORK 17, N. Y. • ELDORADO 5-3200

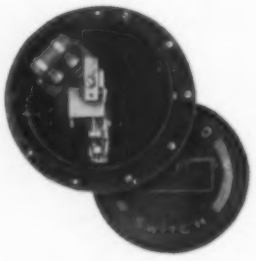
THE LARGEST PRODUCER OF LEAD IN THE UNITED STATES

MERCOID CONTROLS

FOR VARIOUS INDUSTRIAL APPLICATIONS

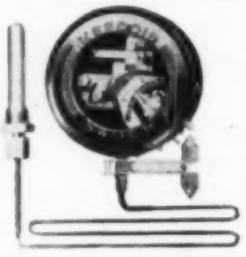
The only 100% Mercury Switch equipped controls.

If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff—always at your service.



Diaphragm Controls

Float Operated Controls



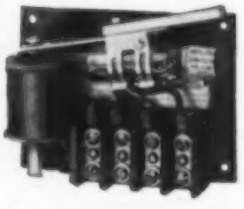
Temperature Controls

Explosion-Proof Liquid Level Control

Limit Controls

Line Voltage Thermostats

Pressure Controls

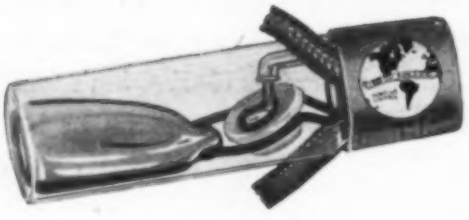


Relays, Panel Board Mounting Type

Explosion-Proof Thermostat

Complete Mercoid Catalog sent upon request

MERCURY SWITCHES BY MERCOID



They are not affected by dust, dirt or corrosion and have many definite applications where open contacts are not suitable. Various types available. MERCOID is your guarantee of the best in mercury switches. Further information sent upon request.

THE MERCOID CORPORATION · 4223 BELMONT · CHICAGO · 41 · ILL.

it has been shown that fungus spores are able to reduce sulphur vapor to hydrogen sulphide, which is toxic and kills the spores. Thus again we have the spores committing suicide.

Sulphur-resistant spores are relatively inactive in producing hydrogen sulphide. However, if sulphur-sensitive spores are also present, they may produce enough hydrogen sulphide to kill the resistant ones.

One other theory as to how the copper in Bordeaux mixture becomes solubilized is that the fungi take up copper from the minute traces in solution and build up a toxic dose. It has been shown that they can accumulate copper in this manner, but it seems unlikely that this alone can explain the toxic action.

In the early days there was much emphasis on the solvent action of carbon dioxide and ammonia in rain water on the dried residues of Bordeaux deposited on plants. Weathered deposits of Bordeaux have been shown to become proportionately richer in copper and to show an increase in soluble copper.

S. E. A. McCallan, Boyce Thompson Institute, before American Chemical Society, Washington, Aug. 30, 1948.

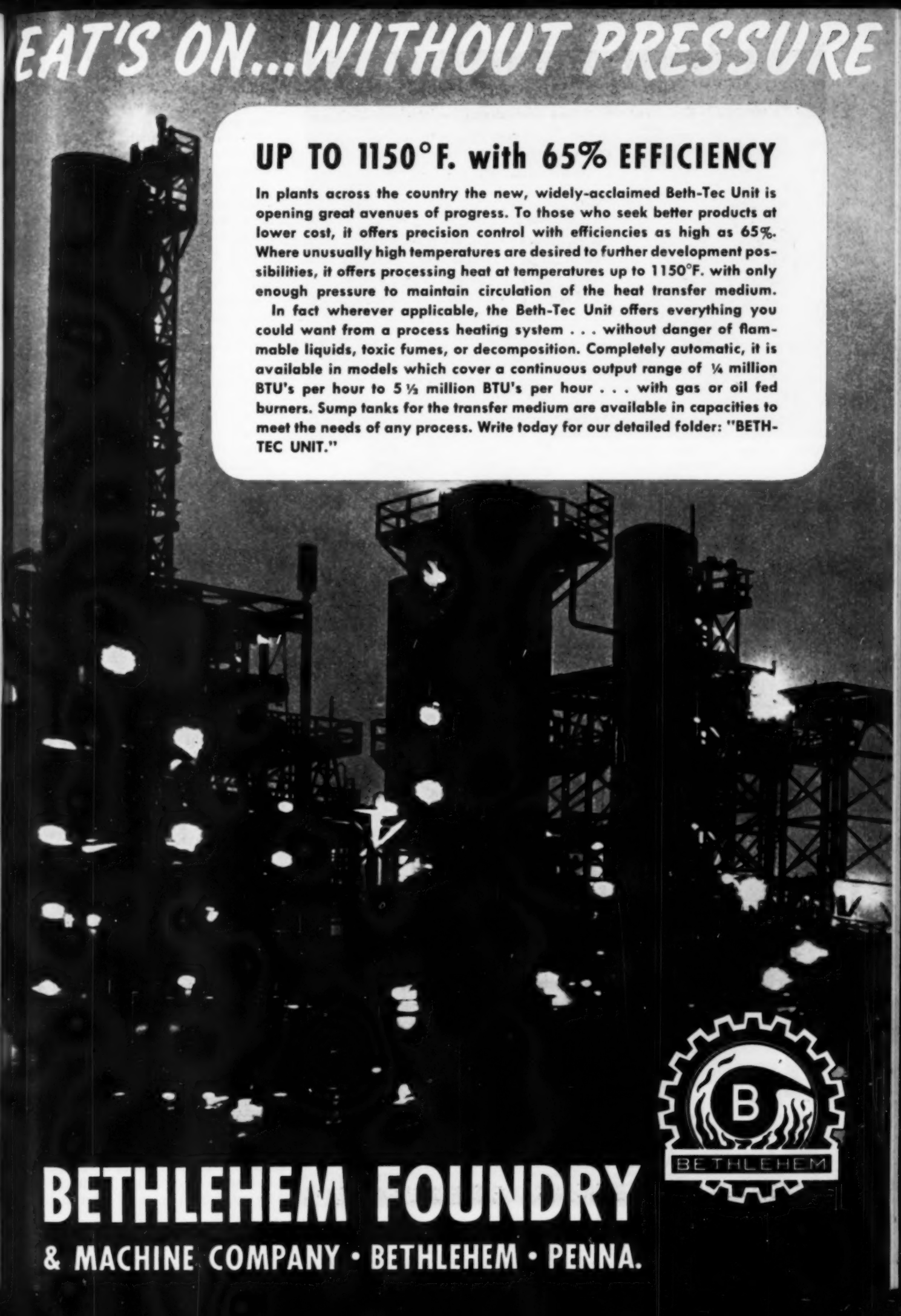
Cresylic Acid

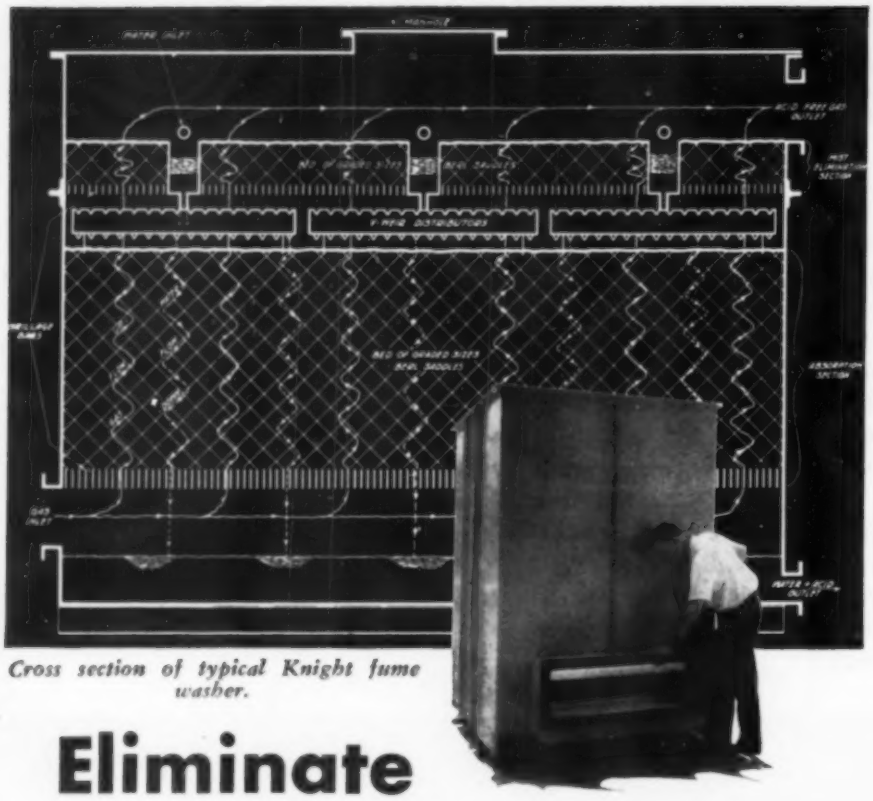
CRESYLIC acid, a coal-tar chemical which a generation ago was employed only to kill bedbugs, is now finding so many new uses in industry that a critical shortage of the compound has developed.

The shortage is so pronounced that petroleum chemicals are being utilized to supplement the cresylic acid obtained from coal tar. At present the petroleum industry produces about 30 percent of the entire cresylic acid output and is endeavoring to increase this volume.

One of the biggest uses of cresylic acid is in the plastics industry, whose output is expanding very rapidly. Of the billion pound production of finished plastics in this country, about a fifth use phenol, cresols, cresylic acid and higher boiling phenols. Cresylic acid is especially useful in moldings, lamination, coatings of textiles, and adhesives.

In addition to a domestic production of 26 million pounds of cresylic acid, this country has found such a large need for them that about 20 million pounds are imported, primarily from England. Another large use of cresylic acid is in ore flotation. With the continual impoverishing of the ores mined in this country, we need more and more agents which will beneficiate the ore so that it can be extracted economically. Cresylic acid


EAT'S ON...WITHOUT PRESSURE
UP TO 1150°F. with 65% EFFICIENCY
In plants across the country the new, widely-acclaimed Beth-Tec Unit is opening great avenues of progress. To those who seek better products at lower cost, it offers precision control with efficiencies as high as 65%. Where unusually high temperatures are desired to further development possibilities, it offers processing heat at temperatures up to 1150°F. with only enough pressure to maintain circulation of the heat transfer medium.
In fact wherever applicable, the Beth-Tec Unit offers everything you could want from a process heating system . . . without danger of flammable liquids, toxic fumes, or decomposition. Completely automatic, it is available in models which cover a continuous output range of ¼ million BTU's per hour to 5½ million BTU's per hour . . . with gas or oil fed burners. Sump tanks for the transfer medium are available in capacities to meet the needs of any process. Write today for our detailed folder: "BETH-TEC UNIT."
B
BETHLEHEM
BETHLEHEM FOUNDRY
& MACHINE COMPANY • BETHLEHEM • PENNA.



Cross section of typical Knight fume washer.

Eliminate CORROSIVE FUMES!

In designing Fume Washers Knight engineers consider individual space and weight limitations, water consumption and fan power, as well as service conditions involved. The result is an engineered functional unit "tailored" to meet your specific requirements. Of Pyroflex or Permanite Construction (depending on service) for complete corrosion resistance, these units utilize Berl Saddles to insure peak performance. Although individually engineered for maximum efficiency, Knight fume washers are relatively low in cost and economical in operation. Some of the jobs handled by these complete functional units include:

Permanite-constructed unit for handling hydrochloric acid fumes.

Removal of HCL fumes
Removal of chlorine fumes
Removal of hydrofluoric acid fumes
Removal of dust from exhaust gas
Production of dilute muriatic acid
Cooling hot acid gases for processing
Suppression of oil and acid mists
Cooling and removing dust from gases and many other types of service.

When writing for information please include full details regarding service conditions.

Maurice A. Knight 111 Kelly Ave., Akron 6, Ohio
Acid and Alkali-proof Chemical Equipment

has been found to be a good agent for the manufacture of a large number of ore flotation chemicals, and about 10 percent of its output now goes into this field.

Textiles, medicinals, dyes, and inks consume another 10 percent of the cresylic acid. Although 30 percent of the cresylic acid is made from petroleum, much of that goes back into the field, as cresylic acid is used in the refining of petroleum for the manufacture of specialty oils and greases. Thus the petroleum industry contributes to some extent to its own raw materials. Cresylic acid is used to inhibit gum formation in cracked gasolines and as a selective solvent in the purification of these gasolines.

Even though bug killing was the only use a generation ago, no cresylic acid is used for that purpose at present. However, the general field of disinfectants and insecticides consumes about 10 percent of the cresylic acid, which is a bactericidal agent.

In order to relieve the critical shortage of cresylic acid, research is under way on the manufacture of synthetic cresylic acid. Since both petroleum and coal tar seem to be inadequate, a new base has been found. This base is toluene, another byproduct of both coal-tar distillation and petroleum refining. This toluene is converted into a mixture of cresylic acids by means of sulphonation followed by caustic fusion.

Toluene is one of the very few chemicals in ample supply at present, since its main use is in the production of TNT. During the war, this country expanded its capacity for TNT enormously. Thus at present we can take advantage of this expanded capacity for the production of cresylic acid.

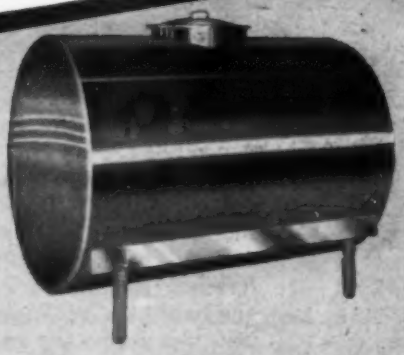
S. A. Savitt, M. W. Kellogg Co., and R. S. Aries, Brooklyn Polytechnic Institute, before Division of Paint, Varnish and Plastics Chemistry, American Chemical Society, Washington, Aug. 30, 1948.

Who Wants to Work for Uncle Sam?

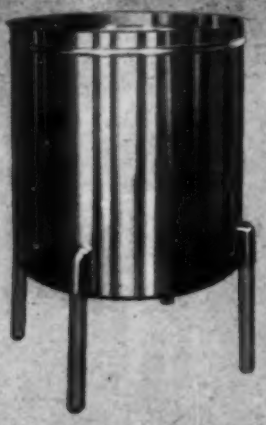
THERE is a disturbing situation that threatens the success of the atomic energy enterprise of this country. It is the increasing unwillingness of specially qualified (and badly needed) scientists, engineers, and management experts to engage in work for the Government of the United States.

This is a dangerous situation. It imperils some of the broadest, deepest and most immediate interests of the people of our country. Should it continue it is clear that it will adversely affect the morale of the large number of men and women all over the country who are working for the government, including those who are pres-

All the Requirements FOR LIQUID PROCESSING



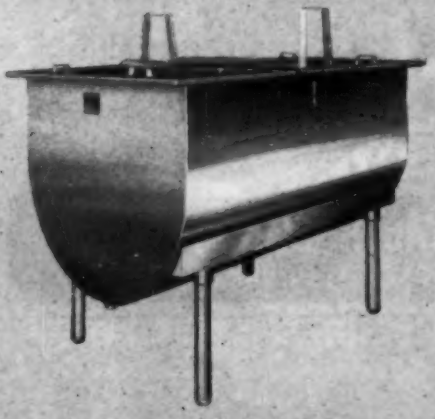
TYPE "H." A mixing or storage tank recommended for low headroom installations.



TYPE "J." A modern design open-top San-I-Tank.

TYPE "K." Closed top tank for mixing or storage.

TYPE "L." Large capacity and low sides for shoulder height operation.



TYPE HALF ROUND. An ideal storage vat for processing liquids or foods.

STOCK POTS. Sturdy, stainless steel utility pots.

are in STAINLESS STEEL SAN-I-TANKS

- A COMPLETE LINE
- STREAMLINED DESIGN
- PRACTICAL CONSTRUCTION
- EASY OPERATING
- SELF DRAINING
- LOW COST

Send today for your free copy of Bulletin SS-48. Contains full information, specifications and data on Single Shell SAN-I-TANKS.

Thousands of industries throughout the world are using SAN-I-TANKS to meet their liquid processing requirements. Whether the operation is mixing, blending or storage . . . in tank capacities from five to 5,000 gallons . . . there's a SAN-I-TANK to handle the job.

Experience gained through many years in the tank fabricating industry has resulted in a complete line of modern SAN-I-TANKS. Durable, stainless steel construction assures long-term service and top operating efficiency that meets every sanitary requirements.

SAN-I-TANKS also feature a full line of accessories including motor-driven agitators, sanitary flush valves, faucets and covers.

For liquid processing equipment that meets your exact requirements check with SAN-I-TANK first!

STAINLESS STEEL SAN-I-TANKS

SERVING THESE INDUSTRIES: BEVERAGE • MILK • FOOD • DRUGS • CHEMICALS • COSMETICS

METAL GLASS PRODUCTS COMPANY

GENERAL OFFICES BELDING 2, MICHIGAN

Designed for Interstate Transportation

HERCULES Aero
(RUBBER CUSHIONED)
CARBOY BOXES

- **CHEMICALS**
- **ACIDS**
- **DRUGS**

Specifications:

SIZE: 17½"x17½"x22"

WEIGHT: Approx. 45 lbs. without bottle.

CARBOY: 13 gallons.

HERCULES CORK-CUSHIONED CARBOY BOXES NOW AVAILABLE!

Other Carboys available in 5 and 6½ gal. sizes.

COMPLIES WITH CLASSIFICATION I.C.C. 1-A

NATIONAL BOX & LUMBER COMPANY
HOME OF HERCULES CARBOY BOXES • NEWARK 5, N. J.

METALLURGICAL PLANT

CONTROLS ACID VAPORS
with a **SCHNEIBLE SYSTEM**

A Schneible Multi-Wash system solves the acid vapor problem at this large metallurgical plant. A section of the carefully engineered, installation for this processor of certain rare metals is shown here. Contaminated air from the acid vapor creating operations is carried in a rubber lined duct system to standard steel Type "HC" Multi-Wash Collectors where it is whirled up through the impingement stages and alkaline liquid wash curtains for cleaning. These collectors feature no moving parts and the exhaust fan on the clean air side. Send for bulletin 410.

CLAUDE B. SCHNEIBLE CO.
Engineering Representatives in Principal Cities
2827 Twenty-Fifth St., Detroit 16, Mich.

SCHNEIBLE

LIQUID-VAPOR INTIMATE CONTACT EQUIPMENT
DUST COLLECTION ABSORPTION
CONDENSATION AND TEMPERATURE REDUCTION

ently engaged in atomic research, development and production—a quite exceptionally able and devoted company of people. It is bound to affect their willingness to continue to contribute their talents and enthusiasm to this vital enterprise.

It is an unhappy aspect of this picture that it should develop at the very time when this nation's extensive atomic energy undertaking has attained considerable momentum, momentum greater than any that has existed since the end of the war.

A healthy atomic energy program simply cannot stand still. It goes ahead, with greater and greater momentum, or it goes to pot. It moves forward, to the answering of new questions, the solving of new problems, the uncovering and development of new knowledge—or it deteriorates. To move ahead it is imperatively necessary that the people of the United States be able to enlist in their service, at once, more individuals of exceptional talent in the fields of science, engineering and management; and it is imperative that this country be able to retain the enthusiastic service of the many unusually qualified people who now are at work on atomic energy, in the nation's universities, industries and on the Commission's staff.

Why this mounting difficulty in persuading some of America's finest talents to make their services available to their government? Why the growing reluctance of institutions and people to become involved in secret work?

For a long time there has been a reluctance to enter government service, for a variety of reasons which have been discussed many times. But that service has now taken on an extra, an added unattractiveness, an added disability: the risk of undeserved injury to a man's good name, his professional standing and his peace of mind through anonymous villification, through attacks from what may be petty or prejudiced or malevolent sources.

The trend shows that as between private industry, educational institutions, and government, government is regarded as the least desirable employer to most scientists. Leading scientific and technical people have warned that the sources of talent are being closed to government.

There is a larger reality. It is this: if such damaging and painful occurrences should become common then inevitably self-respecting men will refuse in ever increasing numbers to work for their government, and this government, and therefore this nation, will be in grievous trouble.

This is a situation none of us wants to contemplate. But it is only by lay-

Up to 20 TIMES Faster

Dissolving & Dispersing

Cowles Ultra-Fast Dissolver

JUDGE the Cowles Dissolver and Disperser not by the simplicity and apparent conventionality of its design, but by the vast increase in its production output. Made by an old-line company, it has behind it years of experiment, wide field experience, and six years' intensive field test. Every machine ever turned out is in active operation today, only earliest models requiring minor replacement of friction parts.

Faster on all miscible and partially miscible solutions, intimately-mingled dispersions and collodial suspensions.

The Cowles Dissolver is a soundly engineered machine of rugged stability, made from the finest materials and equipped with nationally-known bearings, motors and rubber mountings. It departs from conventional practice only in applying a little-used phenomenon of hydraulics to achieve rapid and thorough particle contact between the separate components of a solution or dispersion.

Years of practical experience and field test produce this ultra-fast impeller with its high-velocity interface shear. Drives a portion of the reactants through the main mass of the materials being treated.

By driving a portion of the reactants thru the total mass of the materials being treated, the Cowles Dissolver produces fast, practically true solutions that do not have to stand in order to dissolve suspended particles. Its dispersion and suspensions are so intimately mixed that balling, clumping and sedimentation are avoided.

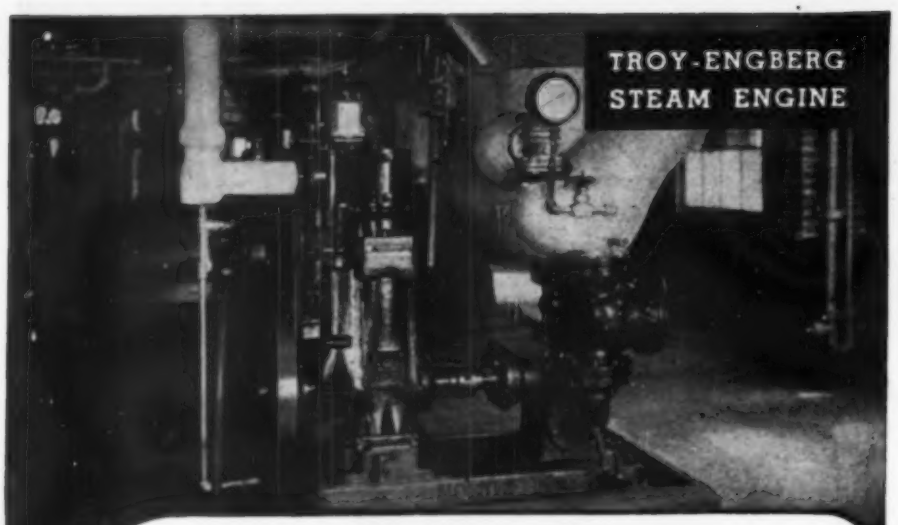
Designed to Your Special Requirements in Dissolving or Dispersing —

- ★ liquids in liquids
- ★ solids in liquids
- ★ gases in liquids

WRITE FOR DESCRIPTIVE FOLDER . . . or ask for a technical representative to call. No obligation.

The Cowles Company
INCORPORATED, CAYUGA, N. Y.

Associate: Alexander Fleck, Ltd., Ottawa, Ont.



PRODUCTION AT LOWER COST

BY MEANS OF POWER at LOWER COST

Would you like to drive that pump or compressor – or blower, fan or cooker ... for practically nothing after a year or two?

There is a strong probability that you can do so if you use a Troy-Engberg Steam Engine. This drive, widely used in the process industry, is operating in many, many plants at practically no cost after paying for itself completely in a short time. The power is By-Product power, a by-product of the steam being used for heating or processing.

If you have need for the following combination in your plant–processing or heating steam and equipment that requires a drive–you probably have a perfect setting for a Troy-Engberg Steam Engine.

TROY ENGINE & MACHINE COMPANY
Established 1870
1300 Railroad Avenue • Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

ing this situation before the country with candor and forthrightness that the answer can be found.

That answer lies in re-assertion of our basic confidence in the level-headedness, the fairness and the hard common sense of the American people as a whole, and of the fairness and responsibility of the overwhelming majority of the press and radio.

That answer lies in the development of procedures such as your Atomic Energy Commission has been working out that will ferret out the relatively few unreliable and disloyal individuals, without at the same time subjecting decent, conscientious and utterly loyal citizens to unwarranted fears and terrible injuries.

That answer lies in a faith all of us share that democracy is worth more to us as individuals than the price—the not inconsiderable price—that it sometimes exacts of those who, entering the service of their government, risk the hazards of abuse and distortion and defamation.

David E. Lilienthal, Atomic Energy Commission, before American Association of the Advancement of Science, Washington, Sept. 16, 1948.

M Means Mobilization

AMERICAN industry must be ready for instant mobilization in the event of another war. It is generally felt that any future emergency would come rapidly and we would have little time for preparation.

Now we have a situation where we are planning for an emergency in which we would be attacked, but we don't know when, where, how or by whom. Even the question of who would be our allies could throw the calculations off substantially.

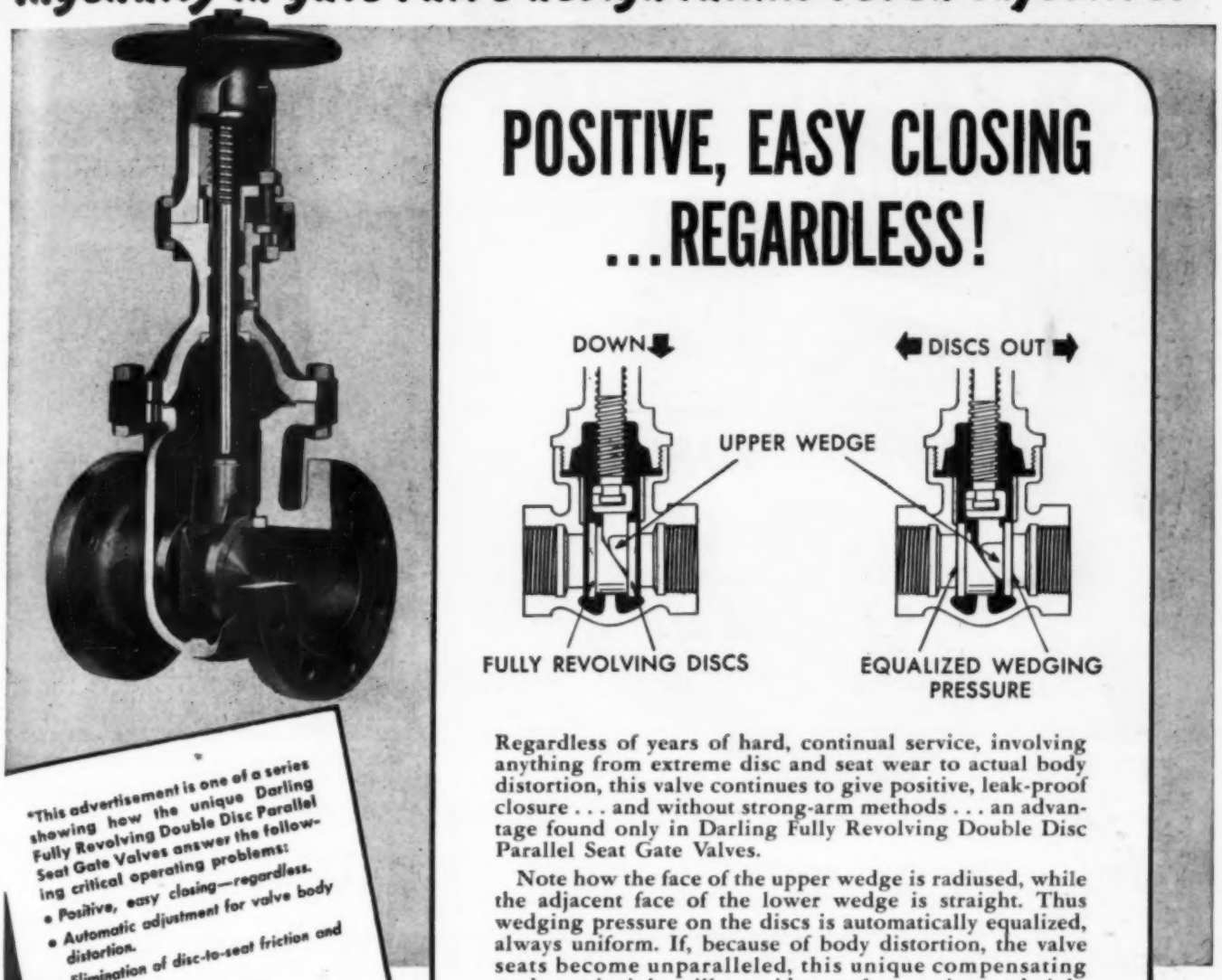
The National Security Resources Board is a civilian agency, planning solely for a future emergency. The Board's most vital responsibility is the determination of the demand-supply relationship of all essential commodities in time of war. It is a peacetime organization planning for a possible emergency, and an organization that could be quickly expanded to administer its plans.

By doing such planning ahead of time, we will more quickly reach the well-coordinated effort that it took us several years to accomplish after the start of the last emergency.

It is not the purpose to have plans filed in Washington and familiar only to a small group. Rather it is the purpose to have a government agency making plans with the help of and familiar to the people who would be affected by operation of the plans.

Planning is particularly difficult for

*Ingenuity in gate valve design fulfills seven objectives**



*This advertisement is one of a series showing how the unique Darling Fully Revolving Double Disc Parallel Seat Gate Valves answer the following critical operating problems:

- Positive, easy closing—regardless.
- Automatic adjustment for valve body distortion.
- Elimination of disc-to-seat friction and galling.
- Uniform wear distribution.
- Extreme simplicity.
- Greater service life.
- Simplified maintenance.

POSITIVE, EASY CLOSING ...REGARDLESS!

Regardless of years of hard, continual service, involving anything from extreme disc and seat wear to actual body distortion, this valve continues to give positive, leak-proof closure . . . and without strong-arm methods . . . an advantage found only in Darling Fully Revolving Double Disc Parallel Seat Gate Valves.

Note how the face of the upper wedge is radiused, while the adjacent face of the lower wedge is straight. Thus wedging pressure on the discs is automatically equalized, always uniform. If, because of body distortion, the valve seats become unparalleled, this unique compensating wedge principle still provides perfect seating and tight closure without forcing.

The discs themselves are free to revolve fully and seat in a different position at every closing. Uneven wear, another common cause of leaks, is definitely avoided.

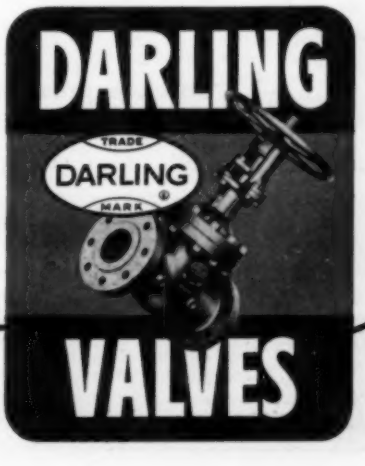
Combine these unique features—automatic seating adjustment and uniform wear—and it's easy to see why these Darling Valves can always be counted on for positive, easy closing—regardless!

DARLING VALVE & MANUFACTURING CO.
Williamsport 3, Pa.

Darling Parallel Seat Gate Valves are available in a wide range of sizes and for all types of normal and unusual service, and for pressures up to 3000 pounds. Likewise, Darling Taper Seat, Solid or Slotted Wedge Gate Valves are available for most services.

Corrosion resistant valves. *In addition to conventional iron, bronze and steel types, Darling specializes in valves for any corrosive fluid: iron body valves with special alloy trim; iron body, rubber lined, with special alloy trim; all bronze; and all special alloy. Darling's 60 years of experience in meeting unusual requirements is always at your service.*

Outline your needs and ask for specific data on the proper Darling Valves... or send for the complete 300-page Darling Catalog No. 17M. It describes Darling Valves of *all* types and is full of valuable information.



THE VALVE MARK OF QUALITY . : : WATCH FOR IT

KINNEY
HIGH VACUUM PUMPS

Have you considered the possibilities of vacuum processing in your manufacturing? Perhaps your product can be produced better, faster, more profitably with the help of Kinney High Vacuum Pumps. Whatever the quantity and degree of vacuum you require, Kinney Pumps will deliver it on a production basis, dependably and economically.

Low pressure processing with Kinney High Vacuum Pumps has made possible the large-scale production of many of today's wonder products.

Whether your vacuum requirements are measured in *inches* or *microns*, look to Kinney for reliable low pressure performance. Kinney Single Stage Vacuum Pumps will produce low absolute pressures to 10 microns or better; Compound Pumps to 0.5 micron or better.

Write for Bulletin V45.

KINNEY MANUFACTURING COMPANY
3551 WASHINGTON ST., BOSTON 30, MASS.
NEW YORK • CHICAGO • PHILADELPHIA • LOS ANGELES • SAN FRANCISCO
FOREIGN REPRESENTATIVES
General Engineering Co. (Radcliffe) Ltd., Station Works, Bury Road, Radcliffe, Lancashire, England
Horrocks, Roxburgh Pty., Ltd., Melbourne, C. I. Australia
W. S. Thomas & Taylor Pty., Ltd., Johannesburg, Union of South Africa

WE ALSO MANUFACTURE LIQUID PUMPS, CLUTCHES AND BITUMINOUS DISTRIBUTORS

the chemical industry because of the indirect use of its many products, but in most cases the chemical industry's mobilization for war merely means to continue what you are doing only more so.

W. T. Hack, Security Resources Board, before Division of Industrial and Engineering Chemistry, American Chemical Society, Washington, Aug. 31, 1948.

Plastic Fertilizer

SELF-BUDGETING fertilizer, which can supply nitrogen to plants at a predetermined rate over extended periods of time, is now being developed. The new fertilizer is a synthetic material made from urea and formaldehyde and called urea-form.

The nitrogen content ranges from 36 to 38 percent and is in a much less soluble form than the present nitrogen fertilizers. Changing the ratios of reactants changes the solubility of the product and the rate of nitrogen release.

Limited vegetative tests have indicated the controlled release referred to. The material has excellent physical properties and avoids loss of nitrogen by leaching. Other tests of its value are now in progress.

R. O. E. Davis, Bureau of Plant Industry, Soils and Agriculture, before American Chemical Society, Washington, Aug. 30, 1948.

Continuous Viscosimeter for Plant Viscosity Control

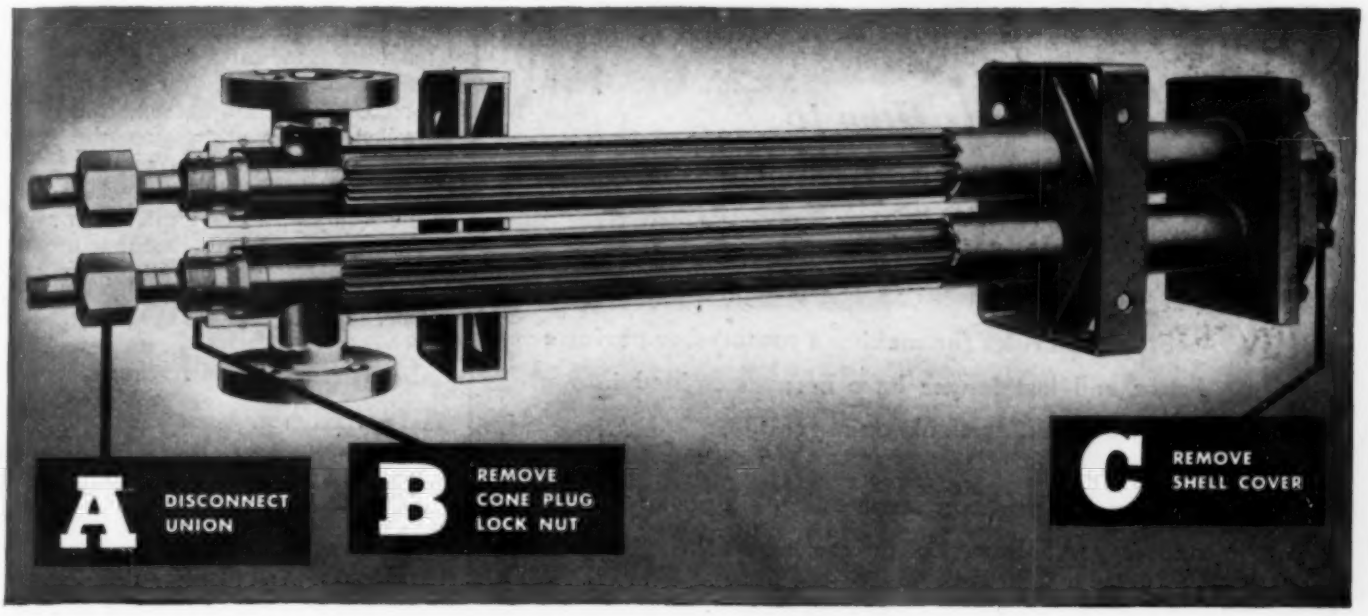
TO SPEED up and simplify viscosity testing of distillates on refinery motor-oil units, the use of a continuous viscosimeter appeared to offer promising possibilities as a rapid method for viscosity determination. This paper reports the results obtained on a typical instrument.

An instrument with the trade name Viscorator was selected for the test work. This is simply a rotameter containing two plummets, one of which is sensitive only to rate of flow and the other especially sensitive to viscosity of the flowing medium.

This instrument is simple to operate, requiring only the adjustment of the flow by a manual control valve to maintain the upper plummet indicator opposite the index flow-setting graduation on the capacity scale. The viscosity can then be read directly from the viscosity scale adjacent to the top of the lower plummet. The temperature of the oil stream is read from the thermometer in the entering line.

Inasmuch as the data on the manual indicating instrument show that, with proper controls, the Viscorator will be sufficiently accurate for viscosity control of motor-oil distillates, recording instruments with proper aux-

as easy as A B C



Convenient Withdrawal of Heat Transfer Elements...one of many **TWIN G-FIN SECTION** *Advantages*

When you want to withdraw the heat transfer element of a G-R Twin G-Fin Section for inspection or cleaning, you need only remove 3 parts. No other heat exchanger has this advantage.

And this simplicity is typical of the Twin G-Fin Section. Its *design* is simple . . . it consists essentially of a pipe within a pipe . . . no tube sheets, no baffles, no internal joints to keep tight. Its *installation* is simple . . . these light-weight standard interchangeable units are readily handled; are easily stacked and connected in series or parallel for the desired capacity and temperature ranges. Its *maintenance* is simple . . . the operating records of more than 40,000 units, some of them in service for more than 15 years, have conclusively proven its durability and low upkeep cost.

Whatever may be your heat transfer requirements, investigate this universal heat exchanger . . . used on a greater variety of condensing, cooling and heat exchanger services than any other design of apparatus.

Write for Bulletin 1614, describing the many advantages and applications of the G-R Twin G-Fin Section.

GR—101

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

MEMO

TO: USERS OF HIGH PRESSURE COMPRESSORS

FROM: NORWALK COMPANY

Booklet Tells How to Get Most Value from High Pressure Compressors

Five basic rules for making a compressor perform better and last longer have been assembled into a handy booklet, available on request.

They are common sense rules, simple to absorb and easy to follow. Yet failure to put them into use is costing compressor users thousands of dollars every year.

We will be glad to send any reasonable quantity that you may wish to have for your shop men.

Reprints of these messages available for your maintenance men

Norwalk Compressors are custom-built . . . of standard, interchangeable parts. This combines the best of craftsmanship and modern methods, to give you a sturdy, reliable compressor, individually assembled and tested for your specific requirements.

NORWALK COMPANY, INC.

10 NORTH WATER ST. SOUTH NORWALK, CONN.

Manufacturers of High Pressure Compressors for Air and Gases for more than 80 Years

iliary flow and temperature-control equipment are being installed on a motor-oil pipe still and on a motor-oil blending plant. The units for the motor-oil pipe still will record the viscosity of each distillate stream.

It has been concluded from the results of all the tests conducted that, when a constant rate of flow can be maintained and the temperature of the oil stream determined accurately, the viscosity as indicated by the Viscorator will be correct to within ±3 sec. Saybolt Universal. For automatically controlled instruments, when the flow rates and temperatures can be more precisely controlled, it is expected that the accuracy will be greater than with the manual indicating instrument.

A. E. Franzen, Standard Oil Co. (Indiana) before American Petroleum Institute, Chicago, Nov. 8, 1948.

Biogeochemical Provinces

SOVIET chemists are conducting exhaustive studies of the distribution of chemical elements in the earth's crust, with special emphasis on the rare and radioactive elements.

The Russians also have stressed physiological and chemical research on the effect of radioactive and rare elements on plant growth. Much work has been devoted to the investigation of the occurrence of rare elements in fresh and salt waters, as well as to the radioactivity of waters, soils and organisms. This led to the discovery of selective concentration of radioactive elements by plants from water solutions and soils. The amounts of radioactive radium, thorium, mesothorium and actinium contained in various sea and land organisms have been described.

Soviet chemists have established the existence of so-called biogeochemical provinces, or regions possessing inadequate or excessive amounts of some chemical elements, which, in turn, cause changes in plant and animal life, and outbreaks of certain diseases.

S. G. Machelson, American Cyanamid Co., before Division of the History of Chemistry, American Chemical Society, Washington, Aug. 31, 1948.

When Skirts Are Long, Dyes Are Short

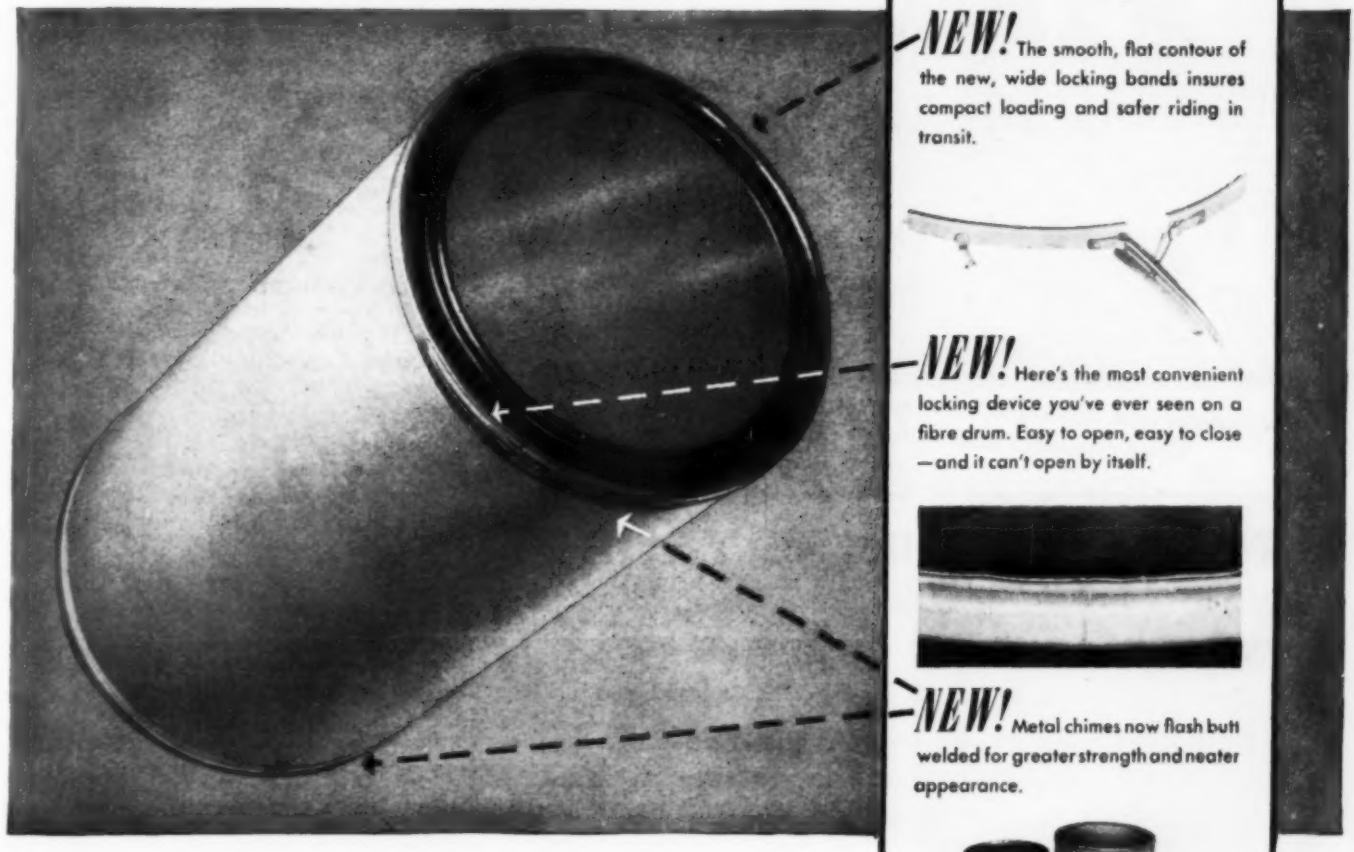
A WAY has been found to spur production of alizarine, a highly important dye which has been in use since ancient times and which, besides its own great value in coloring, is a starting chemical for the manufacture of some 75 other dyestuffs and dyemaking compounds.

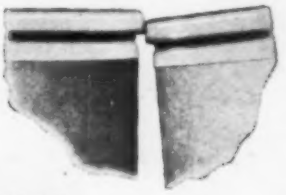
Dyes go short when skirts go long. The rise in demand for dyes which accompanied the introduction of the

ANNOUNCING *Continental's improved*

LEVERPAK DRUM

with "flat contour" locking band for better stowing and shipping

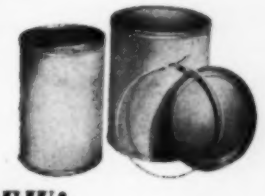




NEW! The smooth, flat contour of the new, wide locking bands insures compact loading and safer riding in transit.

NEW! Here's the most convenient locking device you've ever seen on a fibre drum. Easy to open, easy to close—and it can't open by itself.

NEW! Metal chimes now flash butt welded for greater strength and neater appearance.



NEW! Advances all along the line—improved materials, processes, techniques and equipment.

Here is the best-looking, most serviceable fibre shipping drum we have ever produced. From its newly designed cover—secured by the new "flat contour" locking band—to its easy stacking base, the improved Leverpak drum is engineered for rugged use and re-use.

If you have a dry product to ship, the improved Leverpak is the drum to ship it *in*—for greater product protection, easier handling, better appearance and all around efficiency. May we send you the full details on the Leverpak drum and its shipping mates, the all-fibre Fiberpak drum and the redesigned metal-end Stapak drum? A postal card will bring you the full story without obligation.

CONTINENTAL CAN COMPANY

The Container Company Division

VAN WERT, OHIO

SALES OFFICES: NEW YORK · PHILADELPHIA · CHICAGO
CLEVELAND · PITTSBURGH · ST. LOUIS · LOS ANGELES

FROM THE LAB . . . TO THE PLANT
there's an AMERICAN to fit each crushing job

American Laboratory Mills provide the required action—and exact reduction for pilot plant or laboratory operation, as well as afford an excellent means of sizing soluble or fibrous residues for sewage disposal.

To obtain the highest efficiency on every crushing operation, American Crushers are custom-built to handle *specific* reduction requirements. From small capacity laboratory mills and plastics scrap grinders to large capacity mills for high tonnage reduction Americans assure dependable uniform sizing, and long, trouble-free service.

American "KC" Plastics Grinders rapidly reduce thermoplastic sprues, gates and rejects to uniform, granular size with minimum fines—assuring proper mold flow. Capacities to 450 pounds per hour.

With American's exclusive shredder rings, these AC Ring Mills give high tonnage reduction at low cost. Capacities to 500 TPH.

Write for information on the complete line of Americans.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1219 Macklind Ave. St. Louis 10, Mo.

THEISEN STORAGE TANKS:

Made of

Stainless steel

Aluminum

Monel

Copper

Rubber lined steel

Lead Lined Steel

Can be supplied with stand or legs, covers, level gauges, etc.

Capacities: 10 to 1000 gallons

Process Equipment made to your specifications or engineered by us.

Manufactured by

METAL PRODUCTS CORPORATION

ESTABLISHED 1923

50 West 19th St. Weehawken, N. J.

new look made a serious inroad on the chemical economy of the country, and the scarcity of dyes has increased proportionately.

Even with the present high-pressure process of dye-making, it takes two full days to produce alizarine, which in 1869 became the first synthetic preparation of a naturally occurring dyestuff found in the root of the madder plant. The new method, which employs simple and inexpensive equipment, can produce the dye in a few hours, thus greatly increasing the output. The operation entails a fusion of "silver" salt with lye in the presence of kerosene. A simple distilling kettle, functioning at ordinary pressure, removes water from the product.

Since many actual finished colors come from this one substance, it is of considerable importance in the dyeing of textiles.

D. F. Othmer, et al, Brooklyn Polytechnic Institute, before Division of Industrial and Engineering Chemistry, American Chemical Society, St. Louis, Sept. 6, 1948.

Plasticization

It is the responsibility of the Signal Corps Engineering Laboratory to engage in research and development work leading to the evolution of new and improved electrical and electronic devices. Regardless of the effectiveness of design, unless the materials used in construction are correctly applied, the design is of little value when the equipment is forced to operate under severely adverse conditions.

Four words might be used to define the efforts of the SCEL to improve the performance of synthetic resins and plastics as applied to components and equipment over which the Signal Corps has been assigned custodianship. They are: tropicalization, winterization, miniaturization, and ruggedization.

Tropicalization is the name of the program designed to increase the total resistance of materials to natural conditions common to tropical climates, primarily moisture and fungi.

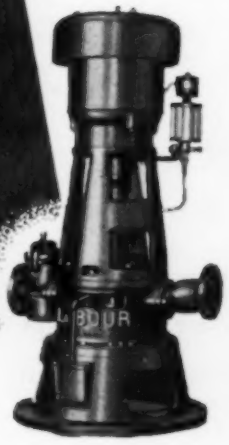
Winterization and miniaturization are considered together because the aims of these programs, as regards temperature resistance, are diametrically opposed. Since one of the trends in the development of communications equipment is in the direction of progressively smaller and lighter units, materials are required which are able to withstand the high operating temperatures caused largely by the decreased ability of the units to dissipate heat.

The problem of increasing the temperature resistance of plastic materials is complicated by the fact that equip-

REQUIRED---

A packingless, self-priming centrifugal pump, for corrosive liquids, aerated solutions, and other difficult chemical applications.

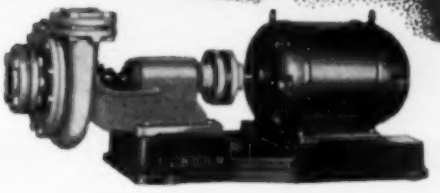
Answer: LaBOUR Type G



REQUIRED---

A simple, efficient centrifugal pump, not necessarily self-priming but able to free itself of minor volumes of air or vapor, to handle various acids and caustics.

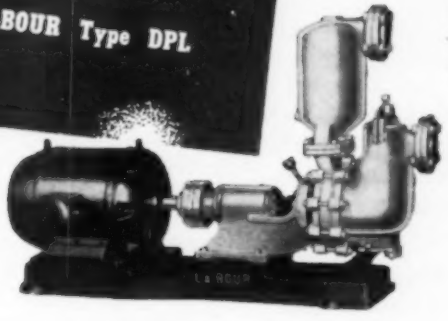
Answer: LaBOUR Type Q



REQUIRED---

A dependable, self-priming centrifugal pump at minimum cost for quality equipment, to handle acids, caustics, "dry" liquids, and liquids containing small solids or fibres.

Answer: LaBOUR Type DPL

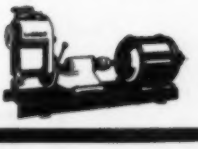


Is YOUR Pumping Need Listed Here?

Tell us your specific problems. Without cost or obligation to you, we will give you specific answers based on proved LaBour performance. Write today.

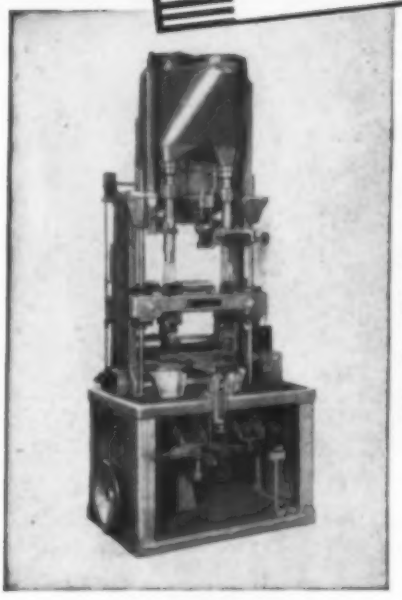
LaBOUR

CENTRIFUGAL PUMPS



THE LABOUR-COMPANY, Inc. • ELKHART, INDIANA, U.S.A.

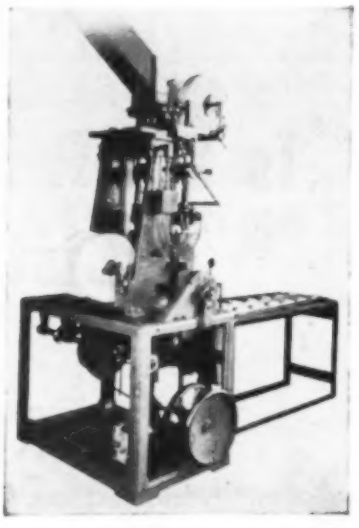
STOKESWRAP



PACKAGING MACHINES

for powders • granules • salted nuts • small candies • crackers • individual pieces and frozen food

Model BS "Stokeswrap" Packing Machine



Model AS "Stokeswrap" Packing Machine

The "Stokeswrap" Packaging Machine feeds the film (printed or unprinted) from the roll, automatically forms the package, fills with the desired amount of the product, and heat seals. Production—50 to 100 per minute. Various types of feeding devices are used to suit the product to be packaged.

We will gladly send complete details. Also, we will furnish sample "Stokeswrap" packages if you will send us a small quantity of your product.

We also make a complete line of

FILLING — PACKAGING — WRAPPING MACHINES

STOKES & SMITH Co

PACKAGING MACHINERY — PAPER BOX MACHINERY

A wholly owned subsidiary of Food Machinery and Chemical Corporation

4914 Summerdale Ave., Philadelphia 24, Pa., U. S. A.

ment must be capable of operating in extremely low temperatures. For this reason, it is necessary to develop materials capable of withstanding operating temperatures up to 200 deg. C., with periods of idleness during which the temperature may drop to minus 55 deg. C.

Ruggedization is the name applied to the program which is concerned with increasing the over-all resistance of Signal Corps equipment to damage under even ordinary temperature and humidity conditions. It is desirable, for instance, to increase the shock and vibration resistance so that equipment can more readily withstand the rigors of transportation, gun-blast, etc. It is also desirable to increase the shelf-life of equipment. In this regard, it means using rubber-like materials which are not susceptible to oxidation, and, using substitutes for polystyrene to avoid crazing.

E. McK. Beekman, Signal Corps Engineering Laboratories, before Society of the Plastics Industry, New York, Sept. 28, 1948.

Molasses Alcohol

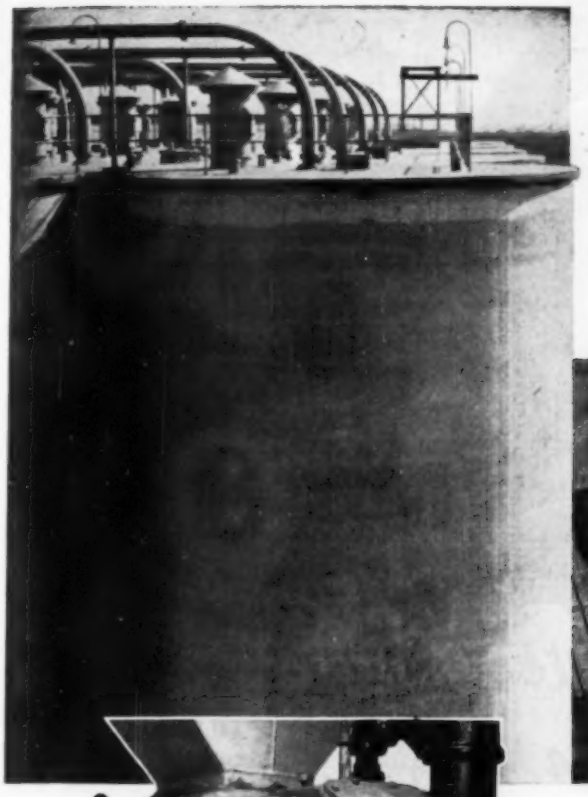
THE FUTURE of alcohol production from molasses is dependent on the availability of sufficient supplies and on a reasonable cost.

In regard to the supply of blackstrap, about 50 gal. are obtained as a byproduct per long ton of raw sugar produced. Therefore, through 1934 the amount of blackstrap available was directly dependent on sugar production.

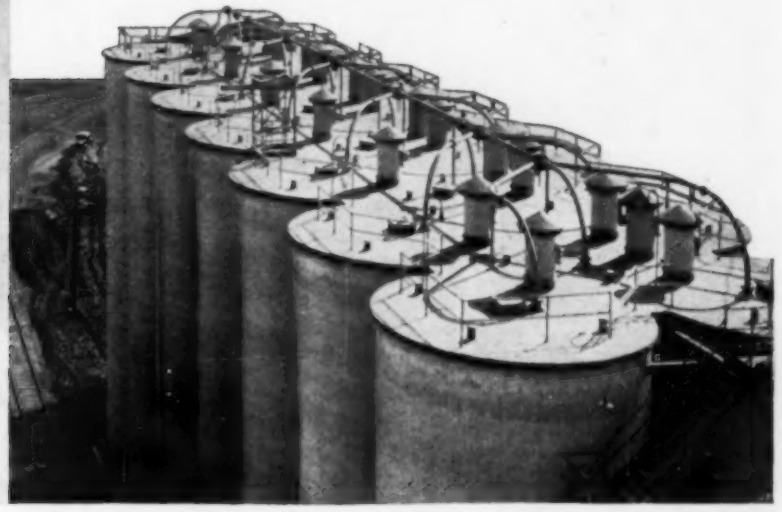
This situation changed in 1935 when Cuban sugar mills began to make invert or high test molasses. This material is produced by adding a small amount of acid to cane juice to make invert sugar, neutralizing and evaporating. The finished product contains about 70 percent of fermentable sugars as compared with 50 percent in blackstrap molasses. As a result, a larger gallonage of molasses became available to the fermentation industries.

It must be borne in mind that the amount of invert molasses produced is not indicative of the total which could have been made. In general the sugar mills limited invert molasses production to the amount required to fulfill contracts which they had made with the fermentation industry. Additional quantities could have been obtained for ethyl and butyl alcohol fermentations had they been needed. It is evident, therefore, that in normal times sufficient molasses should be available to the fermentation industries.

There are several important reasons why the mills should continue to make invert molasses. Sugar cane must be



DISTRIBUTION
THROUGH PIPE LINES



OVERHEAD - - - UNDERGROUND
VERTICAL - - - HORIZONTAL

The Fuller-Kinyon Conveying System is an outstanding example of simplicity of design, having many inherent advantages for the conveying of dry pulverized materials—low operating and maintenance costs, elimination of straight-line conveying, cleanliness, safety for the operator.

Conveying lines—Place them anywhere . . . overhead, underground, run them vertically, horizontally or up hill . . . cut corners to shorten conveying distances. Layouts of new plants can be simplified; old plants moderized without interference with existing buildings and equipment.

Low cost operation—No links, buckets or drags requiring frequent attention, replacement and repairs. Only one moving part, the screw in the pump.

Cleanliness—Materials moved by air through standard-size pipe line. No dust collectors necessary.

Safety—No mechanical or dust hazards. Explosion proof; when handling combustible dusts, the air for conveying is insufficient to support combustion.

When you install a Fuller-Kinyon System, you install a permanent system, one that will last a lifetime with the least possible repairs.

WE BUILD

FULLER-KINYON STATIONARY CONVEYING SYSTEMS
FULLER-KINYON PORTABLE CONVEYING SYSTEMS
FULLER-KINYON REMOTE-CONTROL UNLOADERS
FULLER-FLUXO CONVEYING SYSTEM
THE AIRVEYOR CONVEYING SYSTEM
ROTARY COMPRESSORS AND VACUUM PUMPS
AIR-QUENCHING INCLINED-GRATE COOLER
DRY PULVERIZED-MATERIAL COOLER
ROTARY FEEDERS AND DISCHARGE GATES
MATERIAL LEVEL INDICATORS
MOTION SAFETY SWITCH
AERATION UNITS
SAMPLERS

Fuller

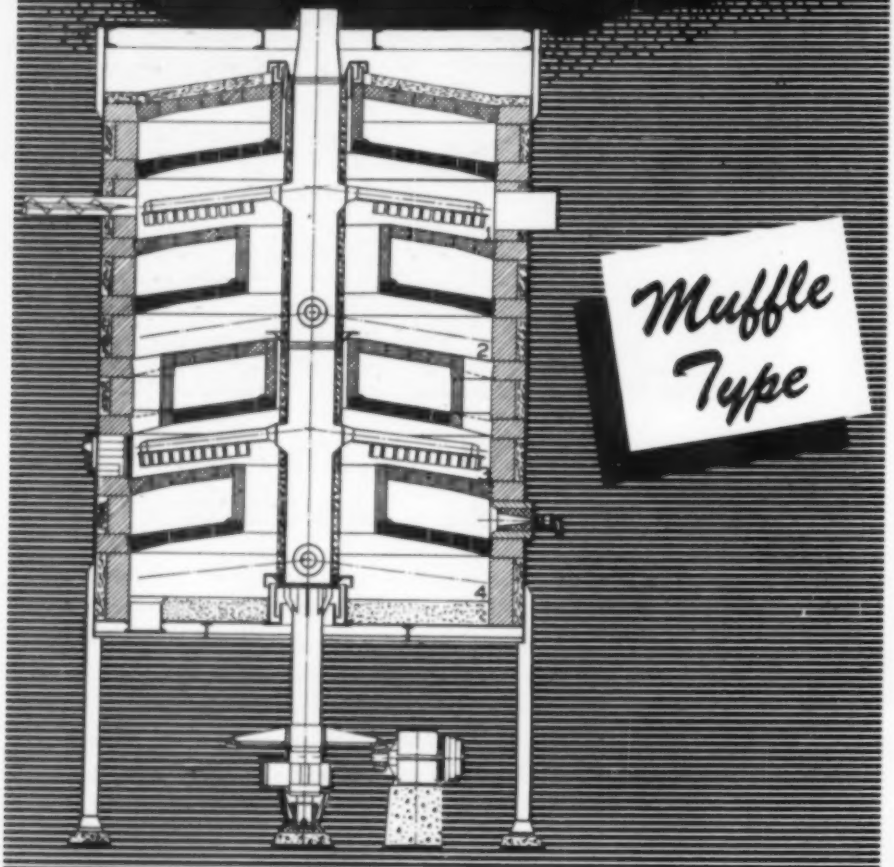
FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago 3 - 120 So. LaSalle St.
San Francisco 4 - 421 Chancery Bldg.

P-80

NICHOLS

Fits the Furnace to the Job



Muffle type multiple hearth furnace—just one of many design modifications of the NICHOLS HERRESHOFF and BETHLEHEM WEDGE ROASTERS. *Consult us regarding others.*

Illustrated is a furnace with four cylindrical hearth spaces each superposed by four cylindrical muffle spaces. The muffle spaces are designed as combustion spaces for fuel. The lower faces of the muffle spaces are designed to radiate heat to material mechanically rabbled over each hearth.

Muffle types are used to recover gases evolved by decomposition, without dilution or contamination by products of fuel combustion, also used to calcine materials without contamination by gases of fuel combustion. For extremely close temperature control, close atmospheric control (reducing—oxidizing—neutral) and a minimum of dusting this type of furnace merits much consideration.

This is No. 1 of a series of special designs.

Watch for No. 2

NICHOLS

ENGINEERING & RESEARCH CORPORATION

60 WALL TOWER, NEW YORK 5, N. Y.

1477 SHERBROOKE ST. W., MONTREAL 25, CANADA

cut periodically, whether or not the sugar is required, in order to conserve the fertility of the land. In addition, it is highly important in Cuba that, to avoid unrest and possible government control, labor be kept employed. It appears then that invert molasses will be available at all times from Cuba.

The price of molasses will be reasonable. Blackstrap molasses cannot be dumped on the ground by the sugar mills, and if they cannot sell it they must take it to sea for disposal. This costs money, and the mills would be better off if they gave the blackstrap molasses away to concerns who would store it and carry it off in tankers. High test molasses will be made for the reasons already mentioned and, on the basis of sugar content, it must sell at the same price as blackstrap.

Before the war it was estimated that in a well-operated large alcohol fermentation plant molasses constituted 75 percent of the total production cost. Since 2½ gal. of molasses containing 50 percent sugar is required for 1 gal. of 95 percent alcohol, it is evident that low cost molasses means reasonable production cost for alcohol.

The cost of a plant to refine the oxygenated compounds obtained in the Fischer-Tropsch process is not low, and the alcohol must be separated not only from materials boiling below and above it, but also from several chemicals which distill at practically the same temperature as does alcohol. Process and amortization costs are not apt to be too low. Plants to produce alcohol from ethylene are costly as compared with fermentation plants of similar capacity. The present plants for making alcohol from molasses were built when costs were much less than half of recent figures and these plants are well depreciated.

Molasses alcohol plants, especially those on the eastern coast, are located in heavy industrial areas so that shipping costs on the finished product will continue to be lower than those enjoyed by the present synthetic alcohol plants or Fischer-Tropsch plants which will be located at the natural gas fields.

C. L. Gabriel, Publiker Industries, before Chemical Market Research Association, New York, October 12, 1948.

Iso-Octyl Alcohols

THE OXO process which converts petroleum olefins into higher primary alcohols by the addition of synthesis gas (carbon monoxide and hydrogen) is a modification of the methanol synthesis as well as the Fischer-Tropsch hydrocarbon synthesis process. This process is an efficient method of converting petroleum olefins into useful

This Thermo-Blo air cooling unit attaches to Linotype machines for the cooling of hot type molds. Manufactured by Mergenthaler Linotype Company, Brooklyn, N.Y.

SIMPLIFIES INSTALLATION

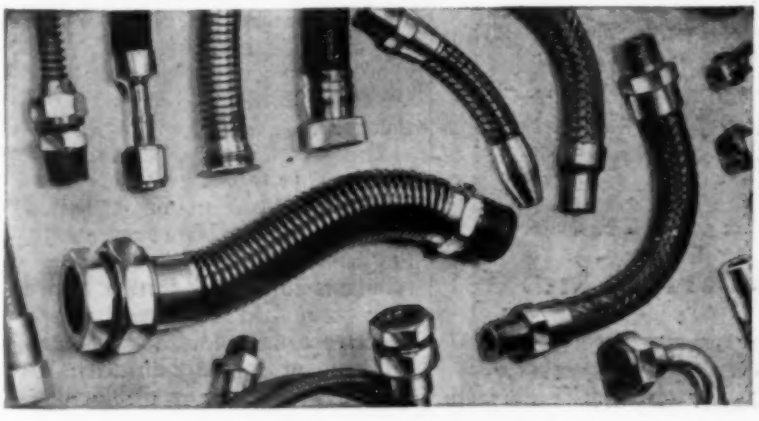
for this cooler of hot Linotype molds

The requirements indicated flexible metal hose: to carry up to 200 cubic feet of air a minute to hot Linotype molds . . . must be rugged, foolproof, quick to install . . . flexibility needed to counteract vibration, simplify alignment.

And American Flexible Metal Hose it was. For this particular application—the Mergenthaler Thermo-Blo air cooling unit for Linotype machines—American selected Type VAC Interlocked Flexible Steel Hose with asbestos-packed joints. The complete assembly is supplied with end fittings attached—designed by American from fitting to fitting at no extra cost.

SPECIAL DESIGN . . . NO CHARGE

Bring your connector problems to American. It doesn't matter whether they involve carrying water, steam, oil, other liquids, semi-solids, gases —or problems of misalignment, vibration, piping in cramped spaces, connecting moving parts. (You may even require a flexible connector of a special, rectangular shape.) An American flexible connector may be your answer. Remember, there's no charge for special design, and your connector can be furnished as a complete, ready to install assembly. Write for literature. 48298



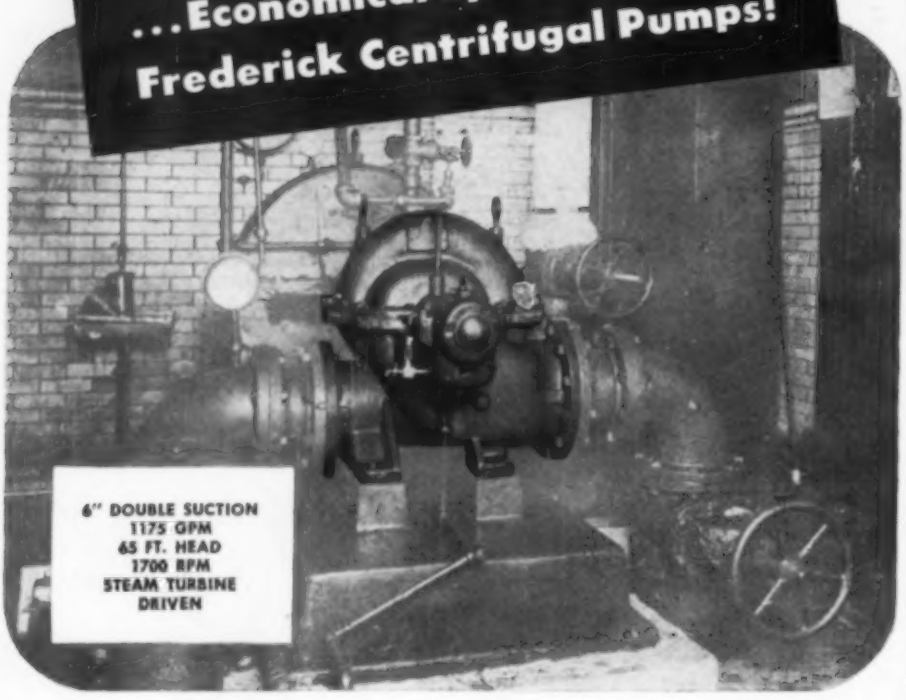
ANACONDA
from mine to consumer

American
METAL HOSE

THE AMERICAN BRASS COMPANY
American Metal Hose Branch
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
Distributed in Canada by:
THE CANADIAN-FAIRBANKS MORSE COMPANY, LIMITED

GET EXTRA LONG LIFE

...Economical operation from Frederick Centrifugal Pumps!



Twenty-nine years ago, Frederick Iron & Steel manufactured its first centrifugal pump . . . a 6" Double Suction Volute type. Delivered in July, 1919, this pump is still in operation today at the Dominion Coal Co. in Sydney, Nova Scotia. Minor repair parts over the 29-year period have been furnished promptly by Frederick. Today, Frederick Iron & Steel is manufacturing a complete line of single and double suction, single and multi-stage centrifugal pumps with the same long-lasting quality built into its first unit. When you buy Frederick pumps you're assured of continuous, economical operation from extra long life.

We have among our designs just the centrifugal pump you're looking for. Drop a line to the address below and we'll gladly send you an attractive, illustrated "file-size" brochure on our pumps as well as the name of our factory representative nearest you. Ask for Bulletin 104.

Frederick

ESTABLISHED 1890

IRON AND STEEL, INC.

Department P-2 REPRESENTATIVES IN PRINCIPAL CITIES **Frederick, Md.**

ALSO MANUFACTURERS OF FRECUT AND FREFORM METALWORKING MACHINERY, FREDERICK STOKERS AND ASH CONVEYORS AND A COMPLETE LINE OF GRAY IRON CASTINGS.

higher primary alcohols which can then be converted into plasticizers for vinyl resins and synthetic rubbers.

Standard Oil Development Co. has adapted the Oxo process to both pilot and commercial plant operation. At present, a commercial plant is being operated by Esso Standard Oil Co. at Baton Rouge, La., to produce an iso-octyl alcohol. Both laboratory and field evaluation indicates that these alcohols are competitive with the phthalate and other type ester plasticizers produced from similar type octyl alcohols now known commercially. In the past the octyl alcohols were in short supply.

Other suggested uses indicate that these iso-octyl alcohols or their derivatives may be used in paint driers, resin solvents, wetting agent intermediates, anti-foaming agents and synthetic derivatives for introducing the iso-octyl group.

W. J. Sparks and D. W. Young, Standard Oil Development Co., before Division of Paint, Varnish and Plastics Chemistry, American Chemical Society, Washington, Aug. 31, 1948.

Promethium

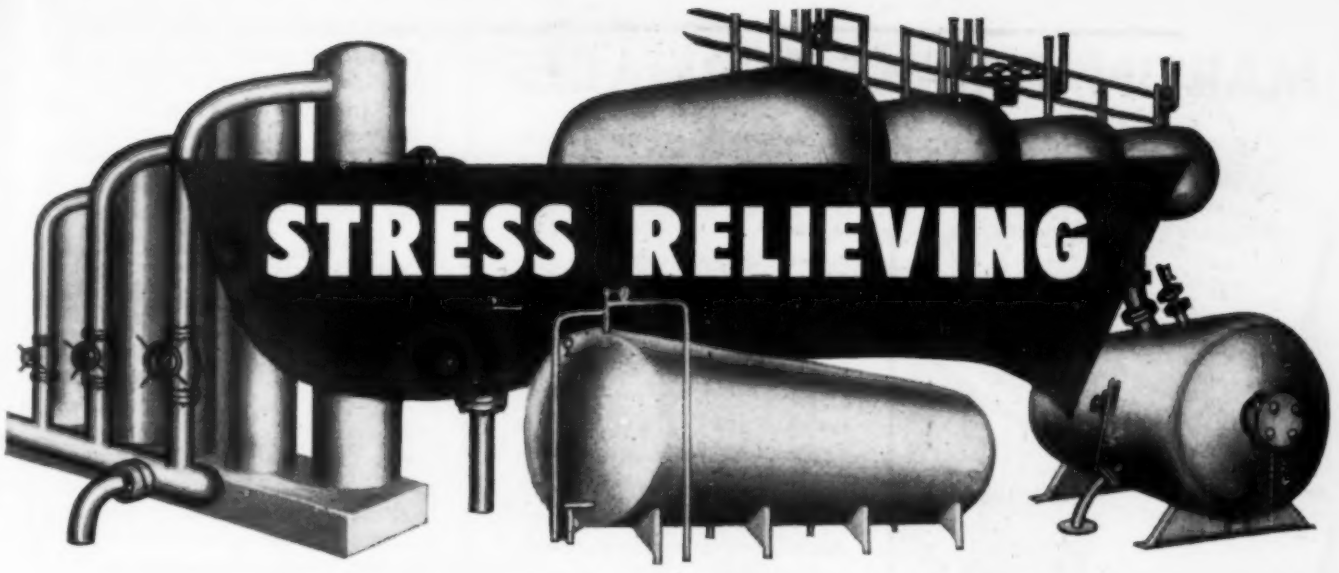
More than twenty years ago chemists in the United States and in Italy claimed discovery of element 61 in natural ores and proposed the names illinium and florentium, respectively. According to Marinsky and Glendenin, who during the war prepared the first pure samples of the artificial element while stationed at Oak Ridge, Tenn., the existence of a naturally occurring isotope of element 61 has not been clearly established.

Should the prior claims be refuted, Marinsky and Glendenin would have the right as discoverers to name element 61. They chose the name prometheum for Prometheus, the Titan in Greek mythology who stole fire from heaven for the use of mankind. This name symbolized the dramatic way in which the element may be produced in quantity as a result of man's harnessing of the energy of nuclear fission.

There is no doubt that element 61 was produced in the atomic pile in two ways, by purification of the products of uranium fission and by bombardment of neodymium with neutrons. It was isolated in a pure form by ion exchange.

The fact that other chemists have been unable to confirm the existence of element 61 in nature is most significant, but probably no more so than the failure of the various groups of claimants to provide further evidence after some had announced new research programs for the isolation of this element in greater quantity.

There should be available now at



Temperature Ranges Required for Pressure Vessels at BLACK, SIVALLS & BRYSON, Inc. Demonstrate Controllability of *GAS*

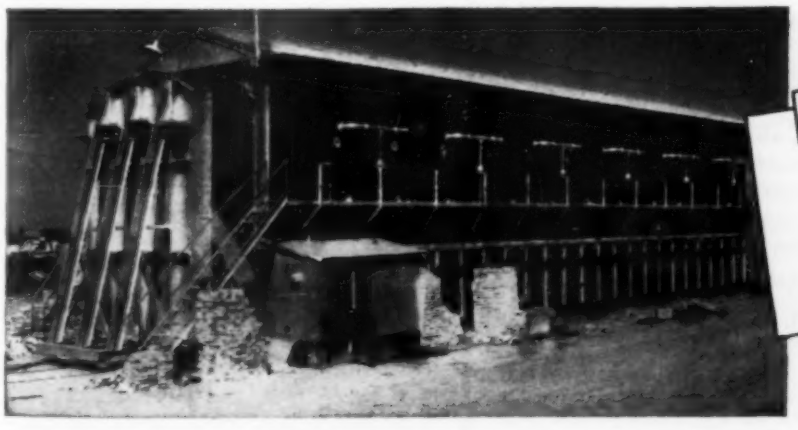
Safety codes govern many of the manufacturing and testing methods for pressure vessels. One of the most important processes, stress relieving, requires precise control of temperatures throughout the cycle—just the type of temperature control to be found in thousands of industrial applications of GAS for heat treating.

Specialists in the manufacture of pressure vessels depend on GAS for heat processing of all types. The pioneering firm of Black, Sivalls and Bryson, Inc., Kansas City, uses GAS in the manufacture of tanks, valves, pressure vessels and safety heads. President A. J. Smith says,

"Throughout the past 25 years we have depended on GAS to provide the exacting temperatures for our work. In many of our plants we have developed special GAS equipment; our large stress-relieving furnace at Oklahoma City is a typical example."

In this large furnace the GAS control system is arranged to provide temperatures up to 1200° F. for any time-cycle required. Automatic regulators and recording pyrometers assure maximum fuel efficiency while the flexibility of GAS is an important factor in maintaining production schedules on vital equipment.

Stress-relieving is just one of the applications of GAS for heat processing. You'll find hundreds of other uses for the productive flames of GAS—they're worth investigating.



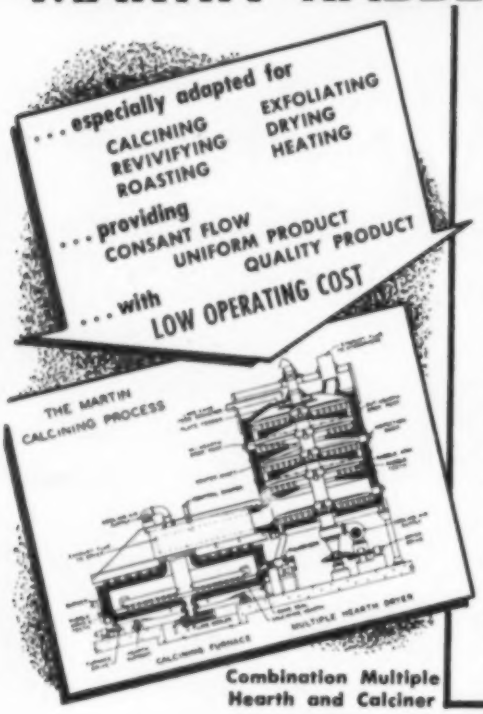
MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

One of the largest stress-relieving ovens in the United States, this installation at Oklahoma City is 77' long, 12' wide, 18' high—Gas-fired and equipped with recording pyrometers.

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE NEW YORK 17, N. Y.

MARTIN RABBLE FURNACES*



Combination Multiple Hearth and Calciner

The Martin Multiple Hearth Furnace is adapted for continuous process rabbling with mass temperatures up to 1800° F. The furnace can be "zoned" for closer control.

The Rotating Hearth Furnace is designed for continuous rabbling, carrying material bed temperatures 1800° F and higher. Special designs can be provided for rabbling up to 2500° F. The unit is especially adapted for reburning of lime, high temperature rabbling of pigments and similar materials where a dust condition would otherwise be troublesome.

This Martin Furnace is capable of considerable flexibility. Why not look into the merits of this furnace for your processing?

*Patents and Patents Pending

Martin Furnace Division

MORSE BOULGER DESTRUCTOR CO.

211-A East 42nd St. New York 17, N. Y

PROTECT YOUR PLANT AGAINST GAS HAZARDS

A four point Davis Continuous Sampling and Recording Combustible Gas Alarm System

DAVIS REMOTE HEAD COMBUSTIBLE GAS ALARM SYSTEM measures flammable gases and/or vapor air concentrations in terms of their explosibility.

Analyzer Head located in area being sampled indicates the gas and vapor hazards under actual temperature conditions. Changes are communicated to—

Control Cabinet in gas free area. When concentrations have reached the alarm point:

1. Red "bull's-eye" shows area causing the alarm
2. Alarm bell in cabinet rings
3. External audible signal sounds in area causing the alarm

For complete technical details, write for Bulletin 1116-F.

INSTRUMENT DAVIS DIVISION

DAVIS EMERGENCY EQUIPMENT CO., INC.

60 Halleck Street, Newark 4, N. J.

the Clinton National Laboratory, relatively large quantities of one isotope of artificially prepared element 61, and spectroscopic data on the synthetic element will settle definitely the validity of claims for the natural occurrence of the element, which are based on spectroscopic evidence.

Jack A. Marinsky and L. E. Glendenin, Massachusetts Institute of Technology, before the American Chemical Society, Syracuse, N. Y., June 30, 1948.

Sulphur Data

SULPHUR is used in the production of a vast number of consumer products essential to the material welfare and comfort of every individual. The element is employed at one or more stages in the manufacture of food, drugs, automobiles, soap, paper, coke, gasoline, lubricating oil, clothing, matches, and paint.

Sulphur has been used since antiquity, but in order to conserve this vital raw material and to use it in the most efficient manner, the scientist and engineer must make thorough studies of the many remaining mysteries concerning its behavior.

All the published data on sulphur have been assembled for the first time and set forth as a compilation and Mollier chart.

These data should facilitate the engineer's work in the design of chemical plant equipment where sulphur is handled. Furthermore, the present knowledge about the thermodynamic properties of sulphur has been brought together in one place. In addition, this publication will help the scientist to recognize the inadequacy of the present information and may stimulate him to greater efforts in this direction.

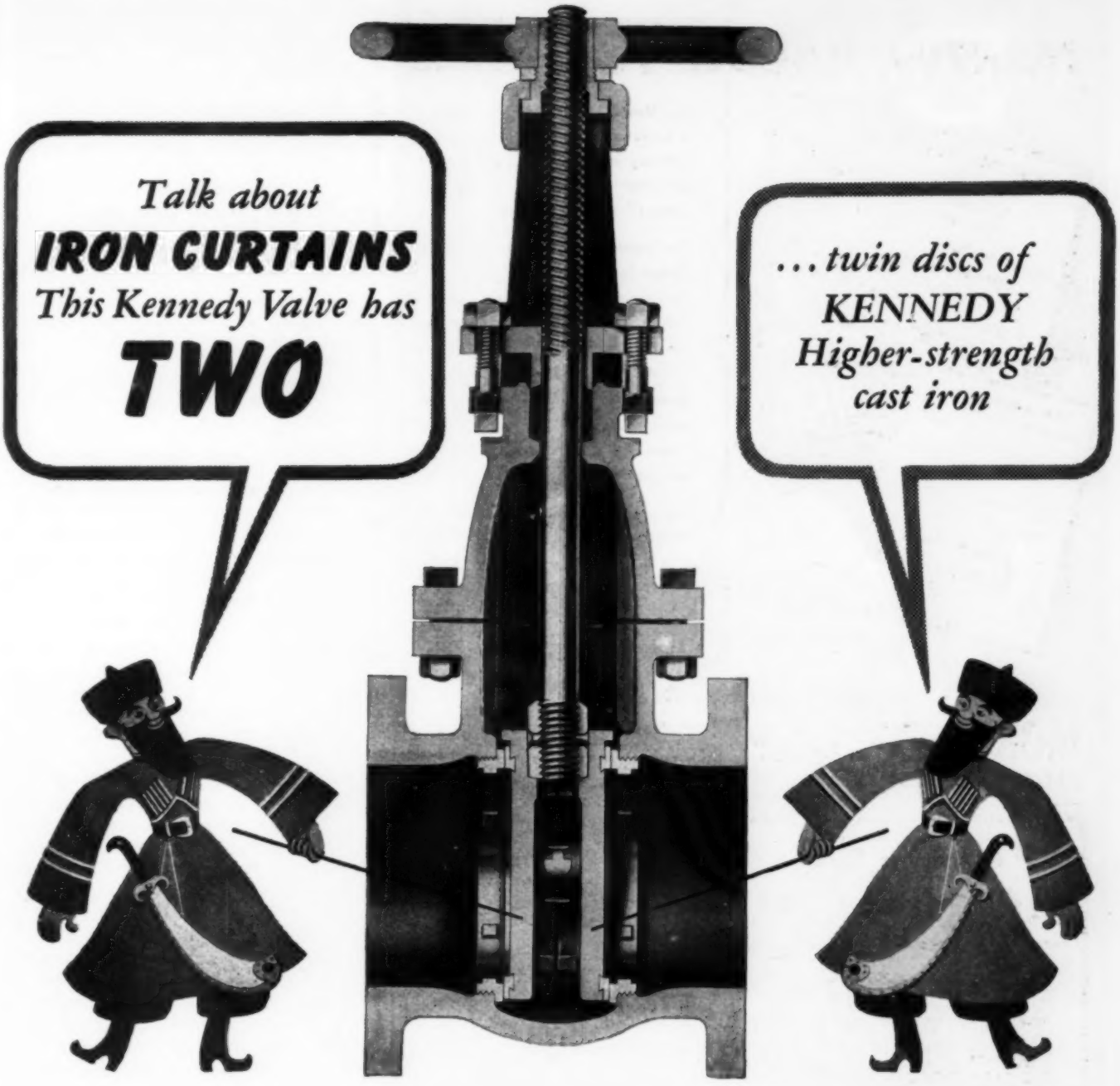
James R. West, Mellon Institute of Industrial Research, before American Chemical Society, Syracuse, N. Y., June 28, 1948.

Longevity Fallacy

SCIENTISTS by and large live no longer than anybody else. In fact, a study of the vital statistics of deceased chemists whose careers were written up in seven volumes of "American Men of Science" revealed that their average age at death was about 61, which is considerably under the current life expectancy of 64.5 years for men and 69.5 for women recently announced by life insurance experts.

Although only chemists who died between 1900 and 1944 were covered in the survey, there can be no doubt that the conclusions reached are also valid for physicists or any other specified group.

These findings are considerably at variance with a widespread impression created by the fact that many re-

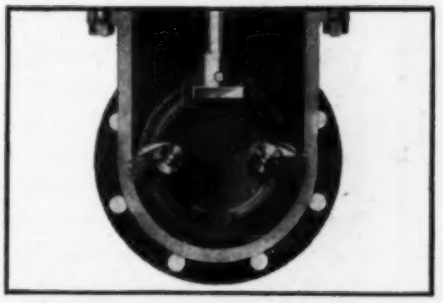


When you close a Kennedy Iron-Body Double-Disc Gate Valve, you drop a *double* iron curtain...twin discs of Kennedy Higher-strength Cast Iron – double assurance of complete closure, even when grit is present in the liquid being handled. As soon as the port opening is completely closed, a wedging device between the discs drives them apart . . . forcing each disc against its seat. If grit is caught on one seat, the other seats tightly.

The lodgment of sediment or the position of the valve will not affect the action of the cams and discs. Operation is perfect with either disc toward the pressure.

Every Kennedy valve...Iron-Body or Bronze...gate, globe, angle or check ...is designed with equal care to give reliable performance in its particular application.

BUY FROM YOUR LOCAL DISTRIBUTOR.



Kennedy Iron-Body Double-Disc Gate Valves are available with non-rising stem or outside-screw-and-yoke, for low, standard, medium or extra heavy pressures, in a full range of standard sizes. The Kennedy 240-page catalog contains full details.

KV-177

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK

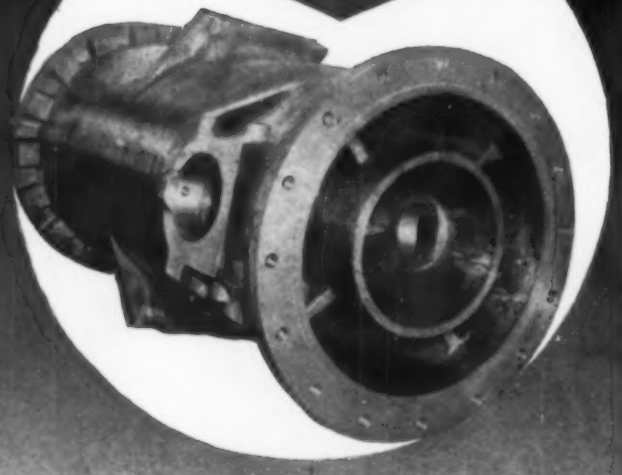
Office and Warehouses in principal Cities

KENNEDY valves-pipe fittings-fire hydrants

DURALOY

Roasting Furnace CENTRAL SHAFT SECTION

TYPICAL OF OUR HEAVY CASTINGS



That's quite a piece of metal — that roasting furnace shaft. It weighs about 5300 pounds and is fully machined ready for assembly. Yes, we have a completely equipped machine shop, as well as foundry, capable of producing any desired finish on a casting.

With seven electric furnaces having a combined capacity of some 12,000 pounds of metal we're in position to turn out single static castings up to about 6 tons. Centrifugal casting machines range up to about 4½ tons in capacity. This means we can readily produce retorts, autoclave bodies, pump parts, furnace shafts, screw conveyors . . . about anything you need in the way of a casting, large or small, to resist corrosion, high temperature or abrasion.

THE DURALOY COMPANY

Office and Plant Scottdale, Pa. • Eastern Office 12 East 41st Street, New York 17, N. Y.

Los Angeles & San Francisco KILSBY & HAMMON

F. C. NELSON

Detroit F. B. CORNELL & ASSOCIATES

nowned scientist-educators have lived to a ripe old age. However, chemists and other scientists rarely achieve distinction until they are forty or older, and if only noted chemists are considered, those dying young are eliminated and the apparent life span is sharply increased.

Of the various groups of gainfully occupied males, agricultural workers have the greatest life expectancy, followed by professional men, proprietors, clerks and kindred workers, skilled workers and foremen, and semi-skilled workers, with unskilled workers at the bottom of the list.

H. S. Van Klooster, Rensselaer Polytechnic Institute, before the American Chemical Society, Washington, D. C., Aug. 31, 1948.

Proteins and Amino Acids

PROTEINS are contained in every living cell and are involved in all vital phenomena. They have, therefore, an extensive importance in biological, chemical, nutritional, medical, industrial and purely scientific areas.

Proteins are substances of high molecular weight (from 15,000 to many millions). Although many proteins have been prepared in crystalline form, only a few of them have been obtained in chemically pure form so that they may be considered as chemical compounds. The simple proteins are made up entirely of amino acids while the complex or conjugated proteins contain, in addition, carbohydrate, nucleic acid, or other special groups.

There are about twenty different amino acids in proteins and with rare exceptions, every protein contains every one of these in varying proportions. The amino acids occurring in proteins differ greatly in their structure but they have in common an acid (carboxyl) group at one end, next to which is an amino group (alpha-position, therefore "alpha-amino acids"). Due to the asymmetric nature of the alpha-carbon atom, the alpha-amino acids exist in two optically active forms, L and D, of which in general, only the L form occurs naturally in proteins, (therefore, L-amino acids = "natural amino acids").

In the protein molecule the constituent amino acids are linked together by peptide bonds, which form the backbone of the molecule. Although proteins are substances of high molecular weight, in which the constituent units are held together primarily by one type of linkage, the peptide bond, they are not "high polymers," because in high polymers there is usually only one type of unit which repeats itself, while in protein molecules we have a repeating arrangement of as many as 20 different units (i.e.

THERE'S A *Story* BEHIND THIS LECTRODRYER

DRY air from this Lectrodryer has standardized operation of this tray drier at the Arner Company, manufacturing chemists of Buffalo, N. Y.

It happened years ago, before humidity control was recognized as a necessary tool of the process industries.

A foreman complained to a Lectrodryer representative, "I'm getting nowhere with the materials in that tray drier; been stalled for three days." The summer air was loaded with moisture. Its temperature couldn't be increased without injury to their products.

Right next to this drier was Arner's special tableting room, kept DRY by a Lectrodryer. Our engineer suggested extending its air duct to the drier. They started the job at once and, before he left that afternoon, DRY air was flowing to the drier and they could see beneficial results immediately. Later, this other Lectrodryer was installed to serve the tray drier.

Arner's story has been duplicated in hundreds of plants all over the world. Lectrodryer weather has replaced hit-or-miss dependence upon outside weather. Processes have been standardized, production speeded up, products improved.

Let Lectrodryer solve your DRYing problems —air, gases, organic liquids. Write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh, 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sidney.

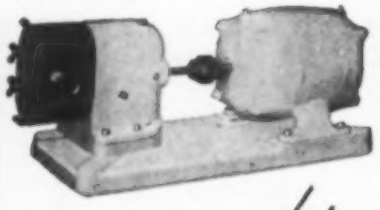
LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

REGISTERED TRADEMARK U.S. PAT. OFF.

WATEROUS SANITARY PUMPS

STAINLESS STEEL 100% SANITARY



for PUMPING MANY TYPES OF CHEMICALS!

A modern advanced design in positive rotary pump, Waterous Sanitary Pumps with ball bearing construction assures long efficient service, on most all chemicals or products being pumped. Heavy duty precision ball bearings control radial and end thrust loads on shafts and rotors. Bearings and timing gears operate in oil for long life and quiet operation . . . no metal friction within the pumping chamber . . . . . double lobe rotor design assures perfect rotor balance and continuous liquid delivery.

POSITIVE ROTARY ACTION

MECHANICAL SEALS

SLOW SPEED ELIMINATES AGITATION

Waterous Sanitary Pumps are self-priming, have accurate volume control and their slow pump speed eliminates agitation or aeration so that thin or viscous materials are pumped without agitation or aeration. Semi-solids can be pumped without crushing the material or jamming the pump. And, many abrasives may also be pumped.

Capacity of Waterous Sanitary Pumps is in direct proportion to the pump speed. Pump can be operated efficiently at speeds ranging from 50 to 600 r.p.m. . . . viscosity of material being pumped is the efficiency factor.

ACCURATE VOLUME CONTROL

CONTINUOUS FLOW

NO BEARING SURFACES IN PUMPING CHAMBERS

REVERSIBLE INTAKE DISCHARGE PORTS

Check the features emphasized here and you'll see why chemical plants prefer Waterous Sanitary Pumps for high quality and efficient service that is backed by 62 continuous years of pump manufacturing.

Write for complete details to:

WATEROUS COMPANY
St. Paul 1, Minn.

DESIGNED AND MANUFACTURED BY EXPERIENCED Engineers

Waterous Dependable SINCE 1886

amino acids). To synthesize a protein we have to combine the 20 different amino acids by peptide bonds in various ways and assemble them in various proportions into a sufficiently large molecule. Therefore it is misleading to call high molecular synthetic substances containing only one or two amino acids "synthetic proteins" or "synthetic protein analogues."

Erwin Brand, Columbia University, and David K. Bosshardt, Sharp and Dohme, before American Chemical Society, Washington, D. C., Sept. 1, 1948.

FOREIGN LITERATURE ABSTRACTS

Chemical Education in Soviet Russia

In Tsarist Russia in 1914 there was a total of 91 higher educational institutions with 112,000 students, and 295 secondary technical educational institutions with 36,000 students. Higher chemical education was in a very undeveloped state in prerevolutionary Russia. Chemical engineering courses were first introduced in Russia by the Petersburg Practical Technological Institute in 1828. In 1917 there were 15 higher educational institutions (seven universities and eight higher technical educational institutions) in which chemists were trained. In the years 1913-1914 only 300-320 chemists with a higher education were graduated in all Russia. The chemical industry was also in a very primitive state and depended chiefly on foreign capital. It imported practically all its raw materials, disregarding Russia's huge natural resources; a large number of Russian plants belonged to foreigners.

In the 30 years of Soviet rule the number of higher educational institutions has been increased almost nine times and the number of students six times. The number of secondary specialized educational institutions has been increased more than ten times and the number of students thirty times. The modern chemical industry was really started in the years of the first and second five-year plans. By 1936, 95.2 percent of the entire production of the chemical industry came from newly constructed or completely remodeled Soviet plants. Higher chemical education developed hand in hand with the industry. There are 160 higher educational institutions which train chemists and chemical engineers. Thirty state universities have chemical faculties which train highly qualified specialists for different

DURA SEAL

FOR MEETING THE SEALING REQUIREMENTS OF VOLATILE, CORROSIVE OR ABRASIVE FLUIDS

THE CUSTOM-BUILT MECHANICAL SEAL THAT provides sealing perfection under conditions not satisfactorily held by conventional packings. DURA SEAL can be readily installed in stuffing-boxes of pumps, agitators, mixers and like processing equipment having rotary shafts.

Write Today

For File No. DSCE covering DURA SEAL applications...

The PERFECT SEAL

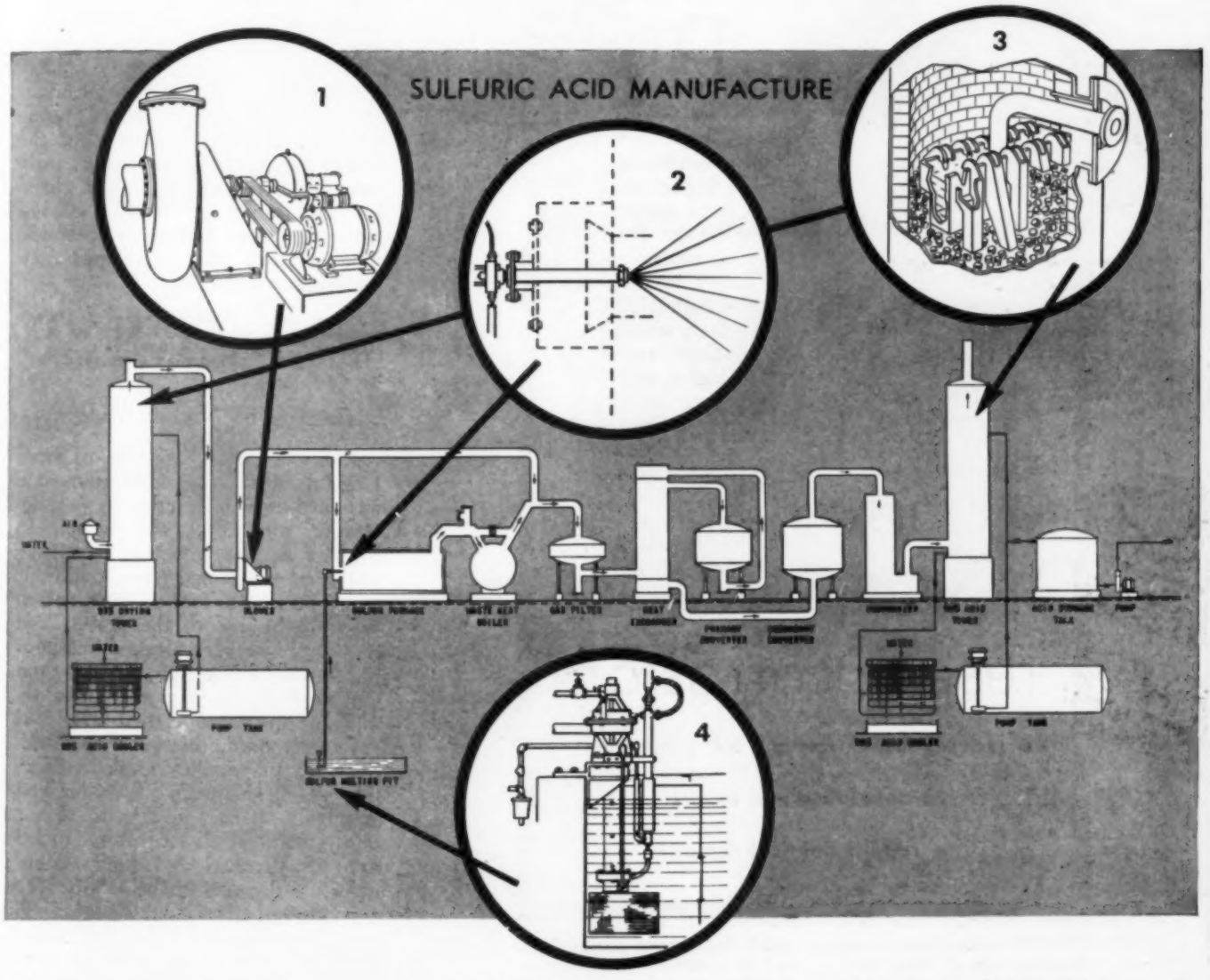
DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

MANUFACTURERS OF METALLIC and SEMI-METALLIC PACKINGS
ROTARY MECHANICAL SEALS and PACKING TOOLS

Chemico Design Features

. . . that increase operating efficiency in a

CONTACT ACID PLANT



Chemico-designed plants have many unusual features of original design which add to operating efficiency. In a Chemico Contact Sulfuric Acid Plant, for instance, you will find these important improvements:

1. Electric motor starting for main blower until steam from waste heat boiler is available to operate the steam turbine.

2. Sulfur gun that sprays liquid sulfur into the furnace under controlled conditions to produce uniform strength SO_2 gas without sublimation.

3. Highly efficient distributors that assure effective contact of acid and gas without carry-over of acid mist.

4. Steam turbine driven submerged sulfur pump that delivers a steady supply of liquid sulfur to the burner.

Properly designed equipment combined with the *right process* is your assurance of trouble-free operation and maximum production in a Chemico-built acid plant.

Chemico Plants are profitable investments

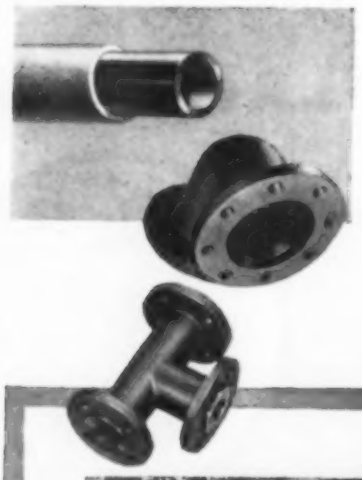
CHEMICAL CONSTRUCTION CORPORATION

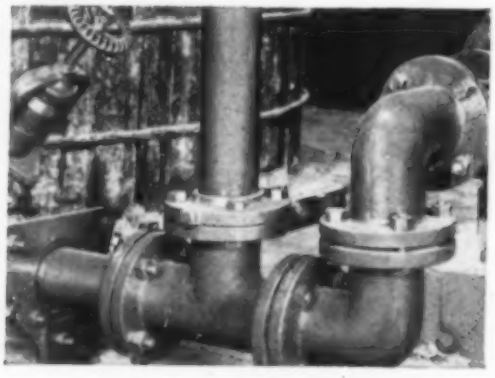
EMPIRE STATE BLDG., 350 FIFTH AVENUE, NEW YORK 1, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE
CYANAMID PRODUCTS, LTD., BRETTENHAM HOUSE, LANCASTER PLACE, LONDON W. C. 2, ENGLAND
CABLES: CHEMICONST, NEW YORK

CC-170

saran lined steel pipe





resists corrosion

- reduces shut-downs and lost production!
- saves time and labor!
- readily field-fabricated!

The conveyance of corrosive liquids can prove as hard on profits as it is on equipment. Saran Lined Steel Pipe is designed and constructed to protect YOUR profits. It combines the desirable features of steel pipe—rigidity and pressure strength—with Saran's unusual resistance to most corrosive chemicals, solvents, and erosion. Another advantage is ease of field fabrication. For general service, Saran Lined Steel Pipe can be used at temperatures between —40° and 190°F.

Saran Lined Steel Pipe comes in maximum lengths of 10 feet and in sizes from 1 to 4 inches. Plug valves and fittings, also Saran Lined, include elbows, tees, companion and reducing flanges, and gaskets. AVAILABLE IMMEDIATELY. Write us today for further information concerning Saran Lined Steel Pipe and how it can solve your problem. Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

SARAN LINED PIPE COMPANY
702 Stephenson Building
Detroit 2, Michigan

Offices in: New York • Boston
Philadelphia • Pittsburgh • Chicago
Tulsa • Indianapolis • Houston
San Francisco • Los Angeles
Portland • Seattle • Toronto

DOW
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

branches of chemistry. Fifteen polytechnic and industrial institutes have chemical-technological faculties which train chemical engineers for various branches of the heavy chemical industry. In addition, there are fourteen branch chemical-technological colleges, three light industry institutes, two textile institutes, eleven food industry colleges, and three wood technology colleges, which train highly specialized chemical engineers. There are 80 teachers' colleges which train instructors of chemistry for secondary schools. More than 20,000 chemical engineers have been graduated during the years of Soviet rule from just the branch chemical-technological institutes of heavy industry. Soviet chemists have found new sources of raw materials, new forms of chemical products and have developed new methods of technology.

Digest from "Thirty Years of Higher Chemical Schools in the USSR" by S. V. Kaftanov, *Uspekhi Khimii* XVI, No. 5, 533-542, 1947. (Published in Russia.)

Reduction of Nickel Minerals

REDUCTION of silicate-oxidized nickel minerals with carbon monoxide was investigated in order to (a) determine whether it was possible to conduct such a reduction effectively and what the temperature conditions would be; (b) to find the relationship between the rate of the process and the degree of reduction of different silicate-oxidized nickel minerals and the conditions under which the reduction process is carried out; and (c) to determine the optimum conditions for practically complete reduction of these minerals with carbon monoxide.

Five different silicate-oxidized nickel minerals were selected from various industrial deposits in the USSR: (a) nepouite-garnerite, containing 37.96 percent nickel monoxide; (b) nickel kerolite, containing 6.46 percent nickel monoxide; (c) nickel deweylite, containing 4.56 nickel monoxide; (d) nickel alumosilicate, containing 19.16 percent nickel monoxide; and (e) "Eydirlite," containing 32.07 per cent nickel monoxide. Reduction of such nickel minerals with carbon monoxide proceeds much more slowly than that of nickel monoxide under similar conditions. These minerals are reduced at different rates and after a period of one hour at 600 deg. they are reduced as follows: (a) 51.4 percent; (b) 30.5 percent; (c) 41.7 percent; (d) 39.8 percent; (e) 24.0 percent. Increase of temperature to 800 deg. and duration of process to 3 hr. is accompanied by a considerable increase in reduction. The first was completely reduced at 800 deg. but

Warm air duct constructed of Apac.

Apac ceiling on industrial-type cafeteria.

Here . . . there . . . and everywhere

K&M "Century" APAC

ASBESTOS-CEMENT SHEETS

for fire-resistant . . . durable . . . economical construction

Exterior siding of Apac on modern industrial building.

You get long-lasting, economical construction when K&M "Century" Apac board is specified for new building, renovations or as a replacement material.

That's because Apac is made of tough asbestos fibers and Portland cement—a hard-wearing combination that resists fire, rodents, termites, rot, rust and weather. And Apac actually improves with age.

"Century" Apac is economical on any job. Initial cost is surprisingly low. Installation costs are low because Apac is easy to cut — just score it, and snap off; easy to apply—fastens in place with nails or screws; and easy to handle—comes in sheets 4′ x 8′ and in thicknesses of 3/16″, 1/4″ and 3/8″.

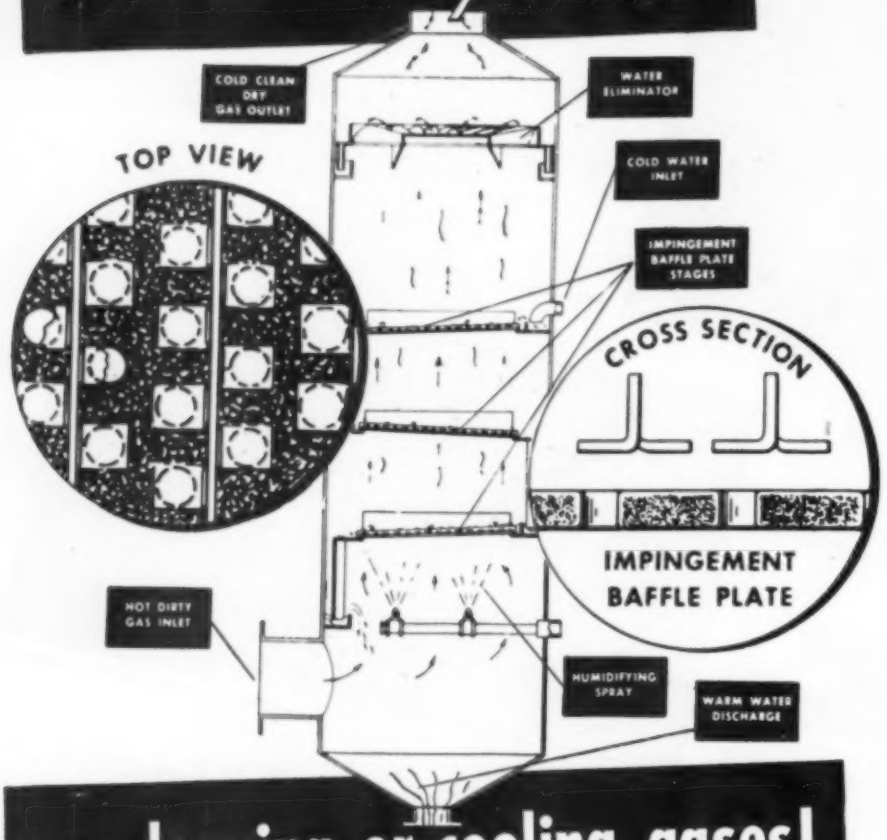
For further information on how "Century" Apac can help solve your special problems, write direct to us. Your inquiry will receive prompt attention.

DIAMOND JUBILEE 1873 1948 K&M KEASBEY & MATTISON CO.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

we welcome *any* problem



on cleaning or cooling gases!

PEABODY Scrubbers, Coolers, and Absorbers have solved many varied problems in a wide range of industries requiring more efficient gas-flow processing and better control of process variables.

no job too big...
no job too small

Typical problems that have been economically solved by Peabody for many leaders in the alkali industry alone, involved gas cleaning from both rotary and vertical lime kilns, dolomite kilns, and ash dryers. Because each problem is different, each Peabody unit is *engineered to job specifications.* You can depend on Peabody experience and engineering to get you maximum efficiency on any gas-cleaning or gas-cooling problem.

Complete details and further information available without obligation. Write for Bulletin 203.

Offices in principal cities

827

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters

the others required a temperature of 900 deg. with varying time of treatment.

Digest from "Reduction of Silicate Minerals of Nickel with Carbon Monoxide" by D. P. Bogatsky, *Zhurnal Prikladnoi Khimii* XX, No. 1-2, 81-88, 1947. (Published in Russia.)

Thermal Conductivity of Insulating Materials

THERMAL conductivity of certain insulating materials was determined by a method based on the known latent heat of fusion of ice. Results obtained with imported glass wool were compared with those obtained with Brazilian slag wool, diatomaceous earth, animal wool and corkboard, as shown in the attached table. Slag wool can be produced in Brazil in sufficient quantities to supply the actual needs of the country.

Material	Density (Kg./Cu. M.)	Relative Insulating Efficiency
Glass wool	91	100%
Slag wool	113	85
Slag wool	165	86
Natural diatomaceous earth	119	55
Calcined diatomaceous earth	98	100
Calcined diatomaceous earth	115	100
Carded felt	66	94
Carded felt	144	100
Corkboard	123	88

Digest from "Tests on Thermal Conductivity of Insulating Materials" by L. A. Pedroso, Publication of Bureau of Labor, Industry and Commerce, National Institute of Technology, 1947. (Published in Brazil.)

Desulphurization of Gasoline

EXAMINATION of the usual methods of desulphurization shows that a condensing agent is particularly suitable for this purpose. In addition to the old standby sulphuric acid, hydrofluoric acid is also used as a desulphurizing agent. A selective refining process was developed for desulphurization of gasoline which uses 98 percent hydrofluoric acid as a solvent. A comparison was made of the desulphurizing action of hydrofluoric acid, sulphuric acid and caustic potash solution with addition of potassium isobutyrate on gasoline. The contents of the examined petroleum fractions boiling up to 320 deg. C. could be desulphurized extensively with hydrofluoric acid. This acid offers the following advantages as compared with sulphuric acid: refining yields and the desulphurizing action are better; unlike the sulphuric acid tar, the hydrofluoric acid extract can be worked up into utilizable products and therefore involves no by-product; the hydrofluoric acid can be recovered by redistillation.

Digest from "Desulphurization of Gasoline" by K. W. Schneider and H. Feichtinger, *Angewandte Chemie B* 20, No. 1-2, 12-16, 1948. (Published in Germany.)

what's back of a purer soap?

In selecting soap, the demand is for purity, cleaning and sudsing power, non-irritation, and low cost. To meet these requirements, soap manufacture must be efficient, precise, and economical. That's why leaders in the industry insure proper filtration by specifying the Sperry Plate Filter Press.

What are some of the advantages offered by the Plate Filter Press? It produces maximum clarity . . . the driest cake, it's easily made of acid or alkali resistant material, yet the initial and maintenance costs are low. These are but a few of many reasons why it is the most widely used filter today.

Let a Sperry engineer diagnose *your* filtration problem, whatever your product. Sperry's facilities and experience are available to you without cost.

D. R. SPERRY & COMPANY *BATAVIA, ILLINOIS*

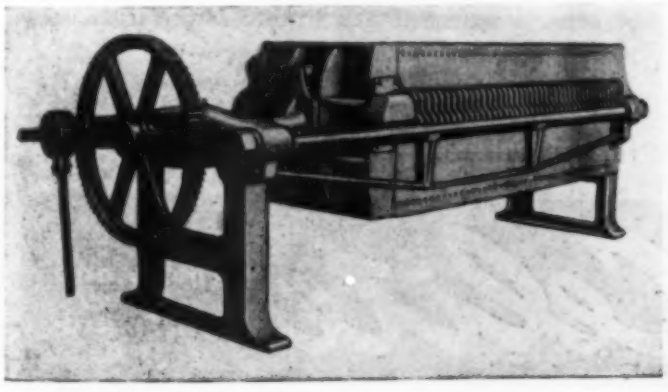
Filtration Engineers for over 50 years

Eastern Sales Representative

H. E. Jacoby, M. E. • 205 E. 42nd St., New York 17, N.Y. • phone: MUrray Hill 4-3581

Western Sales Representative

B. M. Pilhashy • 833 Merchants Exchange Bldg., San Francisco 4, Cal. • phone: Do 2-0375



SPERRY FILTER PRESSES

New...

Catalyst Carriers Preformed

In addition to Celite Catalyst Carriers 408 and 410, illustration shows other available shapes and sizes.

..Celite 408
..Celite 410

Properties	Celite 408	Celite 410
(1) Composition	Diatomaceous Silica	Diatomaceous Silica
(2) Shape	Extruded Pellets	Extruded Pellets
(3) Color	Pink	Pink
(4) Diameter (average)	.175 inches	.275 inches
(5) Length (average)	.156 "	.25 "
(6) Cold water absorption grms. per 100 grms. (average)	55	58
(7) Packed density, lbs. per cu. ft.	36	34
(8) Temperature Resistance	2000 to 2300°F.	2000 to 2300°F.
(9) Reaction	Slightly acid to neutral	
(10) Surface Area (B.E.T. Liquid Nitrogen Absorption) sq. meters per gram	2.4	2.4
(11) Compressive strength psi	5200	2200

HERE are two new Celite* Catalyst Carriers available for carload or less-carload delivery – that provide important advantages in a ceramic support and offer new catalyst carrier efficiency at low volume (packed density) cost.

Available as preformed extruded pellets, J-M Celite Catalyst Carriers 408 and 410 combine high absorption, high porosity, high strength, low density, and large surface area in a microporous ceramic type support.

Celite 408 and 410 have a much larger pore size than most active catalysts. They will absorb up to 60% of their own weight in water...have a compressive strength that makes them extremely resistant to breakdown . . . and exhibit exceptional thermal and steam stability. Their large surface area (2.4 square meters per gram) is equivalent to about 12,200 square feet per pound.

These new J-M catalyst supports will be found unusually economical in such processes as desulphurization, hydrogenation, de-hydrogenation, polymerization, oxidation, isomerization...or wherever the use of silica is indicated. For further information, see your local J-M office, or write Johns-Manville, Box 290, New York 16, New York.

JOHNS MANVILLE JM PRODUCTS

* *Celite is a Johns-Manville registered Trade Mark*

Johns-Manville *Celite* **Fillers and Filter Aids**

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

Anthrone to Carbon-Arc

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. VOL. II. *Edited by Raymond E. Kirk and Donald F. Othmer. Interscience Publishers, New York. 915 pages. $20.*

YOUR second installment payment is due on your set of "Encyclopedia of Chemical Technology." By this, you understand, we mean that the second volume is now available. And it's going to be a lot easier to buy each one as it is published rather than shell out $200 for the complete set. Sort of installment buying wherein you get a piece of the whole thing with every payment.

What's in Vol. II? Well, under "Anthrone" we find "See *Anthraquinone*, Vol. I, p. 945." Under "Carbon-Arc" there are 15½ pages of encyclopedic information on history, manufacture, types, industrial uses and a bibliography. In between, you will find practically everything you expect within this particular alphabetical fragment: antifreezes; asphalt; antimony, barium, cadmium, calcium and their compounds; carbides; and, preceding carbon-arc, carbon-active.

Five entries—antibiotics, antiseptics, bakery processes and products, blood fractionation, and cable coverings—take 106 pages, that's more than 11 percent, of the whole volume. It would be easy to criticize the editors for giving so much space to these and even larger sections which are important but border line to chemical technology. The probability is, however, that the editors d[illegible] credit for keeping their con[illegible]tors' enthusiasm within the bounds they have.

Some time in 1952 or in 1953 when the last volume of the set appears, we will have an easy review to write. We will have used up all our adjectives; thrown all our brickbats. We can just say, "Be sure to get your copy. It's ready now."—*LBP*

Health and Water

PUBLIC HEALTH ENGINEERING. *By Earle B. Phelps. John Wiley & Sons, New York; Chapman & Hall, London. 646 pages. $7.50.*

COMPREHENSIVE text dealing with wide variety of subjects relating to problems involved in environmental sanitation and Public Health. Consists of an introductory chapter, "Man and His Environment," analyzing environmental contacts and the extent to which they are public health problems, followed by 15 chapters devoted to specific development of the nature, scope and solution of these problems.

Divided into two parts, dealing with (1) public health problems as influenced by atmospheric conditions and their effect on man's environmental reactions, with emphasis on nature of such conditions and their corrective measure; and (2) water supplies and water quality, sewage disposal, industrial waste problems and miscellaneous phases of urban and rural sanitation. Text is well supported by charts, tables, diagrams and miscellaneous data.

The author has drawn upon his extensive and rich experience acquired during many years of research endeavor and constructive practice in sanitary engineering. Subject matter has been particularly well organized and coordinated, and written with clarity seldom encountered in technical literature.

A general reference text valuable to all interested in the subject of public health engineering.—*Sheppard T. Powell.*

Engineering Education

TRENDS IN ENGINEERING EDUCATION. *By James Kip Finch. Columbia University Press, New York. 139 pages. $2.*

RECOGNIZING the fact that "continual and never-ending change and improvement is the normal atmosphere of engineering education," this book records the educational philosophy and experience of the School of Engineering of Columbia University.

Two themes are emphasized, in both of which Columbia has been among the pioneers in engineering education. First, the necessity of including the fundamentals of a general education in engineering curricula; and second, the importance of increased attention to engineering research and to graduate education for research. The first need has long been recognized by engineering educators, but it has posed the dilemma of squeezing the "social-humanistic stem" into already overcrowded four-year curricula, or requiring at least another year for graduation. The second theme is a consequence of the late war in Europe. Although American engineers have led the world in industrial organization and production, they have relied to a large extent on foreign research for basic engineering knowledge. This source is no longer available, and American engineering schools must now shoulder the load of advancing the frontiers of engineering science as well as giving instruction to undergraduates. Columbia's approach to the solution of these two problems comprises the major part of Dean Finch's exposition.

Columbia met the general education problem by the adoption in 1914 of six-year engineering curricula. The

RECENT BOOKS RECEIVED

Conversion of Petroleum. 2nd ed. By A. N. Sachanen. Reinhold. $11.

Distillation and Rectification. By E. Kirschbaum. Chemical. $10.

Encyclopedia of Chemical Technology. Vol. II. Ed. by R. E. Kirk & D. F. Othmer. Interscience. $20.

Introduction to Applied Mathematics. By F. D. Murnaghan. Wiley. $5.

Oil Shales and Shale Oils. H. S. Bell. Van Nostrand. $4.

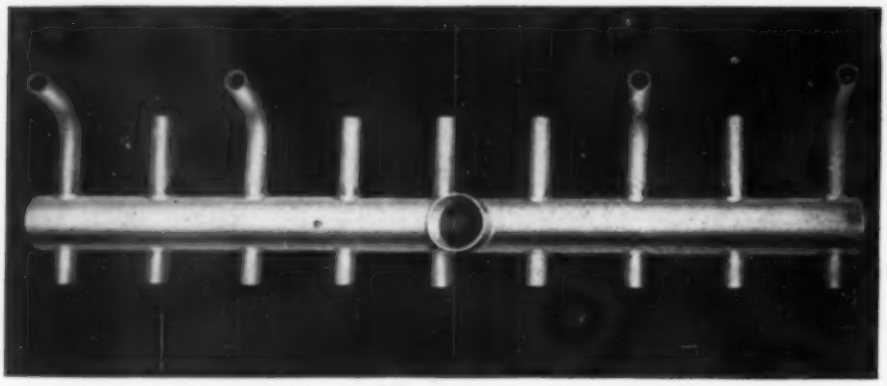
Outlines of Physical Chemistry. By F. Daniels. Wiley. $5.

Principles of High-Polymer Theory and Practice. By A. X. Schmidt and C. A. Marlies. McGraw-Hill. $7.50.

Radioactive Indicators. By G. Hevesy. $10.

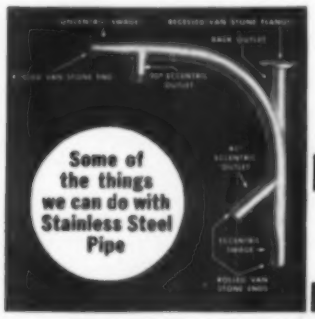
Readings in the Physical Sciences. By H. Shapley, H. Wright & S. Rapport. Appleton-Century-Crofts. $3.

Reagents for Qualitative Inorganic Analysis. By P. E. Wenger & R. Duckert. Elsevier. $7.50.



Stainless Pipe Pre-fabricated by Pioneer Specialists

Fifteen years ago, we pioneered in developing methods for welding and shop pre-fabrication of stainless steel piping. Today, we use the latest "inert-gas-shielded-arc" welding, which has only recently become commercially available. Photo above shows one of fifty headers recently completed, all alike and each to very exacting tolerances. Curved sections were heat treated to very rigid specifications, after bending, then pickled, passivated and re-checked. Insides of welded joints were made absolutely smooth. No job is too large or too small for our facilities and none too difficult for our engineering experience. . . . Most utilities and large industrial plants know the perfection of our patented Westport Welded Joint and our high pressure, high temperature pipe engineering and pre-fabrication, for we have been in this business for 49 years. Write us, or send your prints for an estimate.



WESTPORT JOINT
(PATENTED)
W. K. MITCHELL & CO., INC.
2948 ELLSWORTH STREET
PHILADELPHIA 46, PA.
SINCE 1899

REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA

MITCHELL
PIPING FABRICATORS AND CONTRACTORS

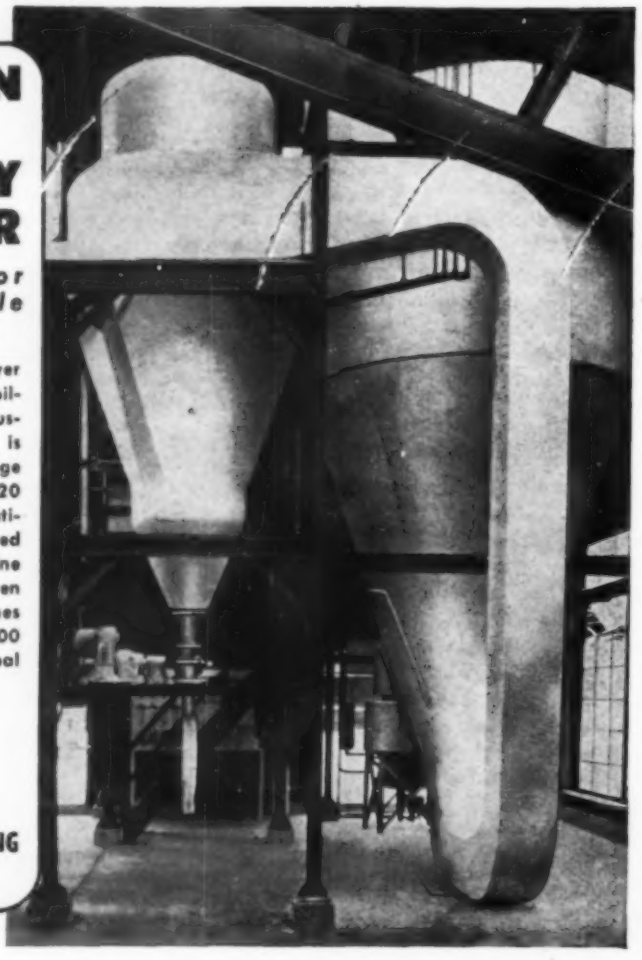
BOWEN No. 4 SPRAY DRYER

. . . new unit for moderate scale production

This compact Spray Dryer has the operating flexibility found in Bowen custom-made dryers, yet is available as a package unit. Production is 5 to 20 tons per day—automatically controlled. Patented Bowen atomizers for fine or coarse particles, driven by Bowen Spray Machines with speed range of 6,000 to 20,000 rpm. Factual data available.

BOWEN

BOWEN ENGINEERING
INC
Garwood 1, N. J.



first three years were spent in Columbia College, the liberal arts college of the University. In his fourth year the student entered the School of Engineering where he had the option of completing one year of engineering study for an A. B. degree in the College, or two more years for a professional degree in the School of Engineering. This plan was modified in 1923 by requiring only two years in the liberal arts college and two years in the School of Engineering for a B. S. degree. A fifth year of graduate work in the student's special branch of engineering was then, and is now, required for the professional engineering degree or, at the student's preference, a master of science degree. The effect of this change was a clear path to fully developed graduate instruction, with resulting expansion in such work and in research.

Dean Finch devotes two chapters to his second theme—research in engineering science and education for research—discussing the problems of adequate recognition of, and support for, such work; selection of promising graduate and research students; and the nature of the study to be undertaken. A major activity of engineering research must be to shorten the time-lag between the discovery of new knowledge and its translation into use.

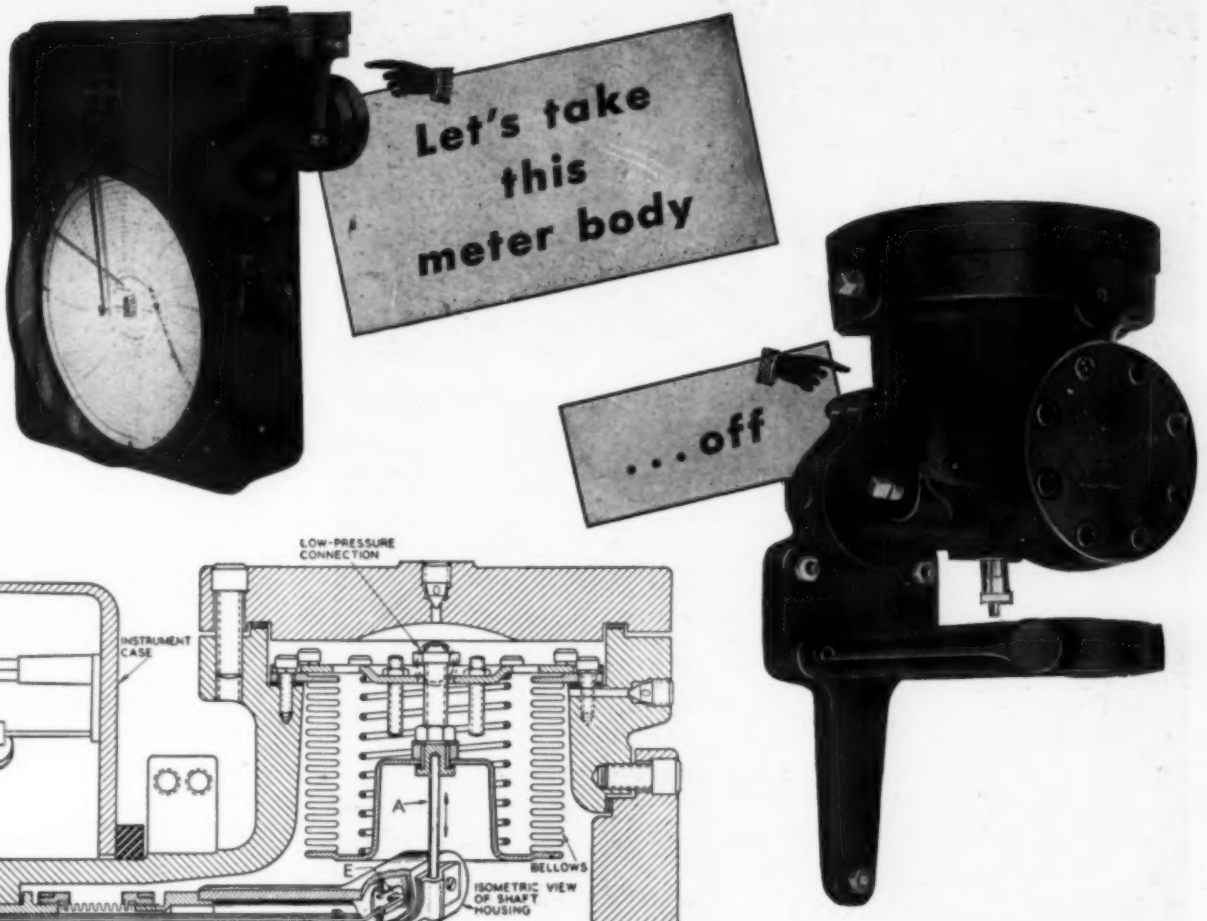
Research and patent policy, a knotty problem sometimes arising from research in educational institutions, is discussed in its general aspects and with particular reference to Columbia's procedure. A chapter is devoted to the undergraduate student, in which the author outlines Columbia's attention to student guidance, scholastic standards, personality development, and placement. An excellent suggestion is made for undergraduate instruction in labor relations, "a field in which the young engineer seldom receives adequate guidance," but in which he is likely to find himself involved.

Dean Finch has written a challenging and thought-provoking document that will be of interest to teachers, students, and industrialists—in short, to all who are concerned with engineering education, its product, and its application.—*H. C. Parmelee*

Symposium

PREPARATION AND CHARACTERISTICS OF SOLID LUMINESCENT MATERIALS. *Edited by G. R. Fonda and F. Seitz. John Wiley & Sons, New York. 459 pages. $5.*

THE 29 papers and much of the discussion presented at the American Physical Society symposium on luminescent solids held at Cornell in 1946



HOW IT WORKS — Connecting rod A, moving up or down with expansion or contraction of bellows, transmits vertical motion to meter body housing, pivoted at flexible portion G. Meter shaft, *sealed off from the rest of the meter body*, is attached to shaft housing at E, forming crank arm D-E. Movement of shaft housing turns crank arm, rotating meter shaft in stationary bearings B and C, and actuating pen arm through connecting link F. Thus, the pen arm, through transmitted motion of the bellows, records differential pressure in terms of rate of flow.

. . . and look inside

. . . to see why BRISTOL BELLOWS-DIFFERENTIAL FLOW METERS are your logical choice for indicating, recording, integrating and automatic control

A STOCK ITEM

Bellows-Differential Flow Meters are carried in stock for *immediate shipment.*

Bristol Bellows-Differential Flow Meters use no mercury or other liquid in the meter body . . . require no accurate levelling or corrections for liquid over mercury . . . eliminate pressure-tight bearings and stuffing boxes, along with pivots, chains, ground joints and knife edges . . . make lubrication unnecessary . . . *and the meter shaft is completely sealed off from corrosive contact with the measured fluid.*

Compared with mercury-type meters, this extreme simplicity of design results in far less inertia in moving parts and, therefore, much quicker response to variations in pressure.

Offered as: Mechanical Flow Meters . . . Electric Flow Meters . . . Pneumatic Transmission Components

Bristol Bellows-Differential Flow Meters and their many applications are described in Bulletin F1603. For your copy, address The Bristol Company, 109 Bristol Road, Waterbury 91, Conn. (The Bristol Co. of Canada Ltd., Toronto, Ontario. Bristol's Instrument Co., Ltd., London N. W. 10, England.)

BRISTOL

Engineers process control for better products and profits

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

Producers of

SULPHUR

Large stocks at our mines make possible prompt shipments

Uniformly high purity of 99½% or better

Free of arsenic, selenium and tellurium

TEXAS GULF SULPHUR CO. INC.

75 East 45th St. New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas

form, the contents of the book. The papers cover six general topics: general characteristics and methods of preparation, recent developments in theory and experiment, factors affecting fluorescent characteristics, storage of luminescent energy, miscellaneous aspects of fluorescence, and luminescence—experiment and theory.

The first section of four papers serves as an excellent introduction to the subject and may be read profitably by those wishing a simple presentation of preparatory methods and general properties. The remaining sections give more detailed accounts of the various phenomena. Many of the papers are of the survey type and afford broad coverage of specialized topics.

The book is equally recommended to those who wish to gain a survey knowledge or to those desiring more specialized information about a subject which is becoming increasingly important from both a theoretical and practical standpoint.

The quality of printing, paper, and make-up is excellent.

—Arthur L. Smith

For Gas Men

GASEOUS FUELS—A DIGEST OF THEIR PROPERTIES, BEHAVIOR, AND UTILIZATION. *Edited by Louis Shnidman. Published and distributed by American Gas Association, New York. 368 pages. $6 to members; $7.50 to others.*

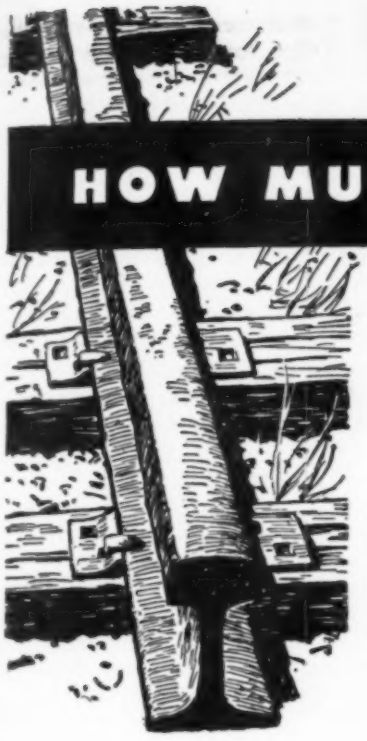
THE gas-utility chemist and anyone else dealing with gas-utility problems can hardly do without this valuable compendium of chemical information. It provides an excellent well-selected elementary and fundamental treatment of characteristics of gases, their analysis and testing, and the principles of production, transmission, distribution, and combustion.

The book is primarily for the gas-utility man and consequently is not as broad as its title indicates. But others outside the industry will find it a valuable guide and reference book if they frequently deal with these subjects.

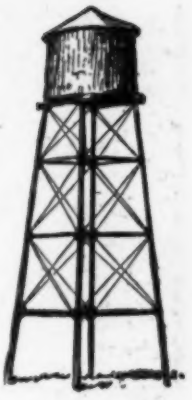
Mr. Shnidman has done an excellent job as editor in blending together chapter contributions from various members of his committee and other collaborators. Inevitably, however, there is some variation in skill of authorship and of readability. But all seems to be quite authoritative and valuable within the specialized range for which it has been prepared.

AGA has also done a nice job of bookmaking; but undoubtedly many librarians and engineers will groan at the format, a large quarto volume which will make storage on the book-

HOW MUCH PRESSURE IS PUT



on SCRAP-COLLECTIONS in your plant?



Scrap collections warrant determined action by top-level management, because output of virtually everything from adding machines to zephyr cloth is jeopardized by the continuing acute scrap shortage.

Take a good look around your plant . . . comb your entire property for broken, worn-out or obsolete machines . . . discarded line shafting . . . unusable girders . . . old chain . . . every sort of scrap metal.

Consult your local scrap dealer for advice on types, grades and sizes.

The amount of steel available depends upon the tonnage of scrap turned in. Everyone is affected by the scrap situation, and now is the time for each individual to get every available pound of scrap back to the mills.

★

MORE SCRAP—MORE STEEL

Move your scrap to the mills

SELL IT—SHIP IT—MOVE IT NOW!

EMBLEM OF INCO SERVICE
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N.Y.

For Reliable Performance...

FILTER UNITS by MULTI-METAL

Advanced design, in combination with improved materials and craftsmanship of the highest order, insures the superior performance of Multi-Metal Filter Units. Whether you require specially-fabricated or stock units, you will find that Multi-Metal is better equipped to serve you.

Multi-Metal's complete reconditioning service makes old filter units perform like new. Filter Leaves for standard equipment are stocked for immediate shipment. Special units can be made promptly to your exact specifications.

Always in stock — wire and filter cloth of all meshes, weaves, and metals. Order by the yard, piece, or roll.

Write for catalog and free wire cloth samples.

More than **35** *years of service to process industries*

Multi-Metal
WIRE CLOTH COMPANY, INC.
1350 Garrison Ave., New York 59, N. Y.

Fletcher

. . . WIDELY USED AND RECOMMENDED

for all around duty by leading chemical engineers, because of largest capacity in proportion to basket diameter; highest speed in loading, acceleration, running, braking and unloading; labor-saving large bottom discharge for solids; and ability to handle unbalanced loads without difficulty. Write for details about these time-saving, production-increasing

MOTOR-DRIVEN SUSPENDED

FLETCHER CENTRIFUGALS

FLETCHER WORKS, 235 GLENWOOD AVE., PHILADELPHIA 40, PA.

shelves something of a problem. But this makeup has permitted the inclusion of some large charts and tables which in a smaller book might not have been practical in usable form and size.—*Russell S. McBride*

Deep Stuff

INTRODUCTION TO APPLIED MATHEMATICS. *By Francis D. Murnaghan. John Wiley & Sons, New York. 389 pages. $5.*

GRADUATE students and workers in various branches of science will find this book a help in gaining a more thorough understanding of the principles of applied mathematics.

Vectors and matrices are treated in Chapters 1 and 2. The concept of function-vectors and of the linear integral operators associated with them make up Chapter 3. Chapter 4 is devoted to the concept of curvilinear vector function. The next two chapters treat the solutions of Laplace's equation which may be derived by the method of separation of variables. Boundary-value problems and the associated Green's function comprise Chapter 7, while Chapter 8 is devoted to the Fredholm and Hilbert-Schmidt theory of integral equations. The last two chapters treat the calculus of variations.—*FA*

Chroma

AN INTRODUCTION TO COLOR. *By Ralph M. Evans. John Wiley & Sons, New York. 340 pages. $6.*

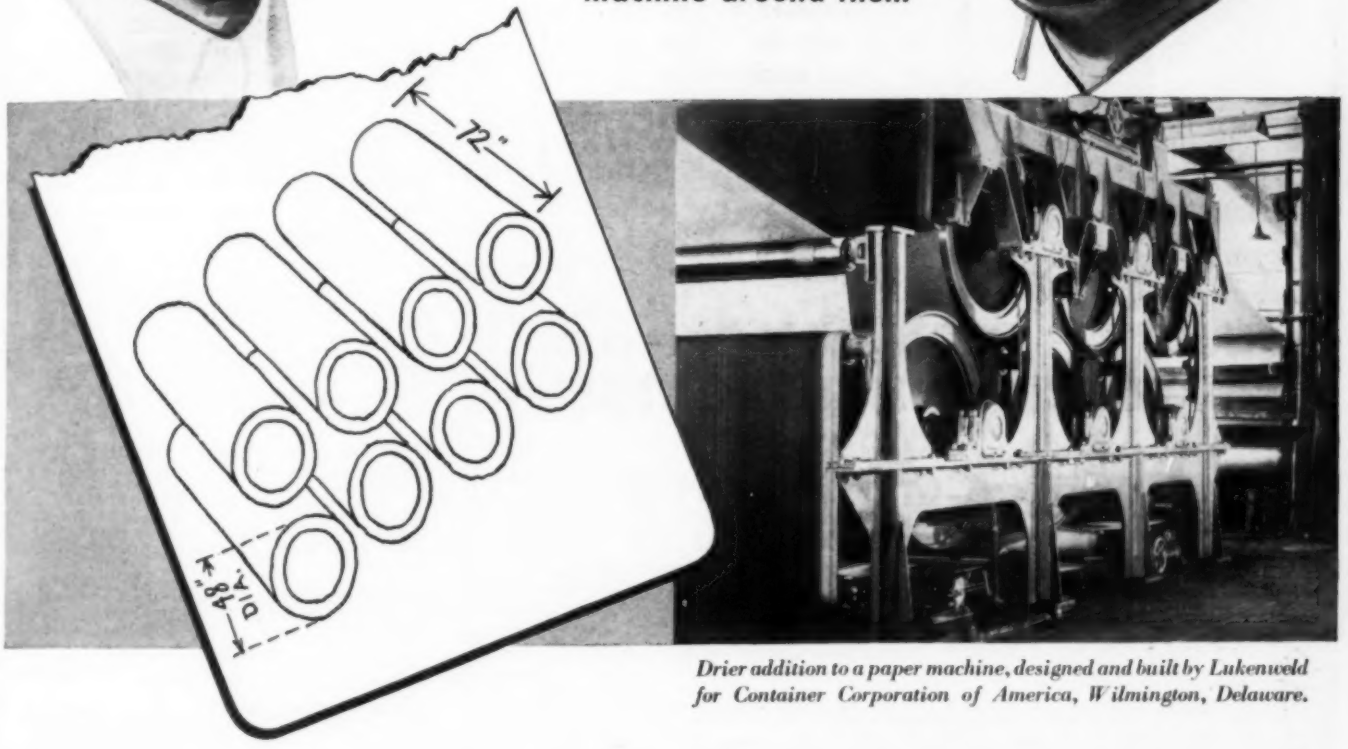
LAST month *Life* published a picture taken at the Dow styrene plant in Texas. This striking color illustration vividly exemplified a trend—colored pipes and equipment tell right away what's inside. Steam lines at the plant are buff; water pipes, green; waste gases, yellow; and steam condensate, brown. All structural steel is bright red. Now, it doesn't take any study of color theory to know that various lines should not be purple, violet and blue. Vividness and contrast are the aim. And what more and more plants everywhere are showing today is an awareness of color—for safety, worker morale and good housekeeping, as well as for coding.

Understanding color, Mr. Evans emphasizes, means mastery of three sciences: physics, physiology and psychology. What he has attempted to do is cover each phase and then tie the three together. He has assumed only a minimum of previous knowledge of any of the three subjects. He makes no apology for his use of mathematics.

The author's success in covering his three fields is probably directly pro-

"EIGHT cast-iron, single-shell drier rolls are needed..."

"SIX jacketed drier rolls will do it, and Lukenweld will build the machine around them"



Drier addition to a paper machine, designed and built by Lukenweld for Container Corporation of America, Wilmington, Delaware.

● To increase the output from one of Container Corporation's paper machines, it was estimated that eight cast-iron, single-shell rolls would be needed to provide the additional drying capacity. Space was limited, so that was a factor.

Lukenweld determined that *six* Lukenweld Jacketed Drier Rolls would accomplish the same results as the eight cast-iron rolls. This would require less space, simplify the supporting structure and reduce costs. Lukenweld designed and built the machine to house and drive the rolls accordingly.

That machine is shown in this photograph at work in their plant—a compact unit packing a lot of production into small space. It is of welded plate construction, providing high strength and increased rigidity with minimum weight.

We at Lukenweld like to take ideas developed by your engineers and operating men and make them materialize. As designers and manufacturers of complete drying machinery, we are well acquainted with drying work in many industries.

May we talk with you about your drying or production design requirements? Write Lukenweld, Division of Lukens Steel Co., 400 Lukens Bldg., Coatesville, Pa.

LUKENS
LUKENWELD DIVISION

DESIGNERS, ENGINEERS AND MANUFACTURERS OF MACHINERY

• • SPEED SCRAP TO THE MILLS TO MAKE MORE STEEL • •

"VAREC" Figure No. 58A Conservation Vent Unit.

7 Reasons for

SAFER VENTING and GREATER CONSERVATION

With "VAREC" Approved

CONSERVATION VENT UNITS

1. GREATER FLOW CAPACITY VENT VALVES
   Expanding streamlined passageways eliminate sharp directional changes of gas flow and resultant eddy currents.
2. LESS "BLOW-DOWN"
   Statically-balanced *hyperbolic* pallets allow quicker opening and closing for true gas conservation.
3. ENTRAINMENT SEPARATOR FLAME ARRESTER
   Grid design permits greater net free area for greater flow capacity and efficient condensate drainage.
4. INSIDE FLAME SNUFFER
   Acts directly on pressure pallet for closure during surrounding fires.
5. NONCORROSIVE and NONELECTROLYTIC MATERIALS
   Materials used are those having high corrosion resistance, low potential and high thermal conductivity.
6. ENGINEERED TO YOUR REQUIREMENTS
   Built with the experience of over twenty years of diversified venting problems.
7. FIELD PRE-TESTED
   All "VAREC" Equipment is pre-tested to actual field installations.

Write for the "VAREC" P-7 Catalog

For full description of the "VAREC" complete line of tank fittings, gas control and safety devices.

"Varec"

CP-1

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, USA

NEW YORK 30 CHURCH STREET | CLEVELAND 1201 EUCLID AVE. | CHICAGO 122 SO. MICHIGAN AVE. | TULSA 723 MAYO BUILDING | HOUSTON 6116 N. & W. BLDG.

CABLE: VAREC COMPTON (All Codes)

portional to their exactness as sciences. Physics is an exact science; the book abounds with wavelength curves of transmittance, reflectance, relative energy and other graphs. Physiology is fairly well understood; Evans explains it well. But psychology seems to be a science of statistics; no one can predict from past measurements on one individual what another will do or see or think under the same conditions —the observer merely has probabilities to go by. It is in this third least-understood realm that *Chemical Engineering* readers will learn the most: effects of illuminants, shadows, brightness and depth perception, and similar problems of the study of light and color.

Who would be repaid for study of this book? Disregard physicists, artists, oculists and photographers. Our list then seems to be: illuminating, safety and design engineers. Then we add company officers responsible for personnel safety and morale, good housekeeping, sales, product purity and packaging.—*LBP*

RECENT BOOKS AND PAMPHLETS

Directory of Western Chemical Producers. Published by Chemical Engineering, 330 West 42nd St., New York 18, N. Y. 20 pages. $1. A directory of prime producers of chemicals in the West. Lists products and plant locations regardless of size or magnitude of operations.

Bituminous Coal, Facts and Figures, 1948. Published by the Bituminous Coal Institute, 815 Southern Building, Washington 5, D. C. 148 pages. Data book about coal. Illustrated with graphs, pictograms and photographs.

Cause and Prevention of Lap Cracks in Steam Boilers. By H. M. Apring and D. E. Carroll. Published by the Mutual Boiler Insurance Co. of Boston, 60 Batterymarch St., Boston 10, Mass. 8 pages. Description of tests conducted during 1948.

A British Survey of the United States of America. Published by the British Information Services, 30 Rockefeller Plaza, New York. 207 pages. $1.15. General economic outlook in the United States and postwar economic policy—from a British point of view.

Streptomycin in the Treatment of Tuberculosis. Published by the Abbott Laboratories, North Chicago, Ill. 28 pages. Concensus of the various cooperating groups most active in the testing of the drug for tuberculosis.

Annual Engineering Undergraduate Award and Scholarship Program for 1948-49. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. 24 pages. Gratis. Rules and conditions.

Corrosion. Vol. 6, No. 2 of Research Publications Illinois Institute of Technology. 121 pages. Eight papers.

Glossary of Packaging Terms. By Gerry O. Manypenny. Published by the Packaging Institute, 342 Madison Ave., New York. 187 pages. $2.75. Basic terms used by trade associations, companies and individuals in the industry.

Plasticity as a Factor in the Design of Dense Bituminous Road Carpets. By L. W. Nijboer. Elsevier Publishing Co.,

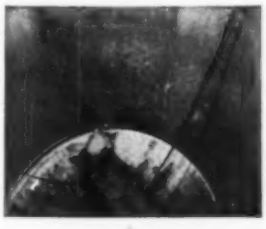
Go Lead for Acid Linings

When you want to line acid tanks or to cover equipment exposed to corrosive fumes or splash ... go for tried-and-true protection. *Go National for Lead!*

Lead resists acid... is easily worked, readily shaped to irregular contours... and can be "burned" to form continuous, corrosion-resistant surfaces.

National Lead brings you different types of lead to suit your conditions. Here are the three basic types:

1 Chemical Lead: This is a practically pure lead, substantially free from bismuth and containing a small amount of copper, which boosts corrosion resistance and endurance limit. It has been used so successfully throughout industry that it is accepted as the standard lead for acid-handling. The other types of lead for industrial use are simply Chemical Lead alloyed with varying quantities of other metals to meet special service needs.

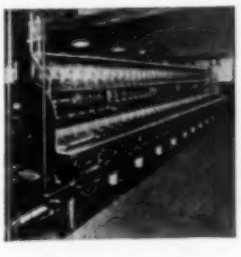


***"One-piece" linings** are obtained with lead. "Burning" the edges of each sheet together gives a continuous corrosion-resistant lining.*

2 Tellurium Lead: This is Chemical Lead to which has been added a small amount of tellurium. You get all of lead's regular advantages plus others needed for specific jobs. For example: one added feature of Tellurium Lead is its increased corrosion resistance at high temperatures.

Another is its ability to work-harden. Mechanical stress, such as bending, stretching or hammering, actually *increases* Tellurium Lead's tensile strength and resistance to fracture.

Use of Tellurium Lead is recommended where you have to fight *both* stress and corrosion.



***Vibration or other fatigue stresses** won't weaken Tellurium Lead. Here, it's used as a protective covering on rayon spinning machines.*

3 Antimonial Lead: This is made from either Chemical or Tellurium Lead by alloying with small amounts of antimony to secure greater tensile and mechanical strength. 6% of antimony added to Chemical Lead almost doubles its tensile strength. This, plus greater stiffness, makes Antimonial Lead suitable where mechanical strain is severe or where linings are supported only by a skeleton framework.

Antimonial Lead also is harder and more resistant to abrasion and cutting. It's a good bet wherever erosion or physical abuse exists. However, as antimony lowers the melting point, we do not recommend Antimonial Lead for use above 240° F.

***Vacuum processing** demands a strong, stiff lead. That's why Antimonial Lead forms the large "cracker pipe" (center) of this partly assembled evaporator for coke by-products. Lead also lines the interior of the evaporator.*

Go National for Lead

... pipe ... valves ... sheet ... lead-lined or lead-covered equipment ... even complete acid recovery plants. Behind every National Lead recommendation, every National Lead product, are years of experience and many important installations in every field handling corrosive liquids and gases.

NATIONAL LEAD COMPANY
111 BROADWAY, NEW YORK 6, N.Y.

Offices and Plants in Principal Cities
Pacific Coast: Morris P. Kirk & Son, Inc., Los Angeles
Canada: The Canada Metal Company, Ltd., Toronto

New Ashcroft Signal Light Duragauge

WARNING!

THE new ASHCROFT Signal Light Duragauge with illuminated warning discs, alerts the operating staff when pressures fluctuate beyond safe operating limits.

The brightly illuminated green bull's eye which indicates normal operating pressures, changes to vivid red when adverse operating conditions call for correction. More than two colors can be supplied for special applications. You specify the pressure color ranges desired.

Widely used as a receiver gauge with pneumatic pressure transmitters, this gauge can be furnished in explosion proof construction, and supplied for panel board or field mounting.

Available with any type of bronze, steel or stainless steel Bourdon tube, micrometer pointer, stainless steel rotary geared movement, and all other Duragauge features.

Stocked and sold by leading Distributors everywhere . . . When you order gauges, insist on ASHCROFT . . . Write for booklet.

ASHCROFT *Gauges*

A Product of

MANNING, MAXWELL & MOORE, INC.
STRATFORD, CONNECTICUT

Makers of Ashcroft Gauges, Hancock Valves, Consolidated Safety and Relief Valves and 'American' Industrial Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties.

215 Fourth Ave., New York. 184 pages. $6.25. A Dutch study of practical applications where plastic properties of bituminous road mixtures prevail.

Wool Wax. By D. T. C. Gillespie. Hobart Publishing Co., Inc., Box 4127, Washington 15, D. C. 96 pages. $5. Technical study covering wool wax, lanolin, cholesterol and the many derivatives and uses of the byproduct of sheep's fleece.

Bibliography of Paper Making and U. S. Patents, 1947. By Clarence J. West. Published by the Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York. 232 pages.

Bibliography on Industrial Radiology 1945-1948. By Herbert R. Isenburger. Second supplement to "Industrial Radiology" published by John Wiley & Sons, 440 Fourth Ave., New York, N. Y. 15 pages. $2.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons or check. Do not send postage stamps. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

Geology and Chromite Deposits of the Camagüey District, Camagüey Province, Cuba. By Delos E. Flint, et al. Geological Survey Bulletin 954-B. Price 75 cents. One of a series of geologic investigations in the American Republics. Maps included.

Statistical Supplement to the Survey of Current Business. Office of Foreign and Domestic Commerce. Price $1. Gives data for the calendar years 1941 to 1946 inclusive in a form most convenient for those making market studies on all commodities and raw materials.

Low-Pressure Lubricating Devices. National Bureau of Standards, Simplified Practice Recommendation R232-48. Price 10 cents. A recorded voluntary recommendation of the trade.

Field-Model Aerosol Machines. By A. H. Yeomans. Bureau of Entomology and Plant Quarantine, ET-258. Processed. Interesting technical information with illustrations of equipment designed primarily for farm and field use, but equally applicable in some measure to indoor insect control by aerosols.

Use of Growth Regulators in Weed Control. Bureau of Plant Industry. A very brief mimeographed statement.

Directory of Activities of the Bureau of Plant Industry, Soils, and Agricultural Engineering, 1947. U. S. Department of Agriculture, Miscellaneous Publication No. 645. Price 30 cents. Vest pocket size. Identifies all the major projects and the active personnel in charge of the research and field staffs of the Bureau.

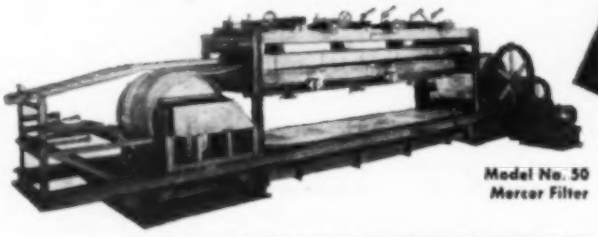
Lonchocarpus, Derris, and Pyrethrum Cultivation and Sources of Supply. By E. C. Higbee. U. S. Department of Agriculture, Miscellaneous Publication No. 650. Price 15 cents.

Animal and Vegetable Fats and Oils, 1943-1947. Bureau of the Census. Series M17-7-07. Processed. A statistical resume of production, consumption, stocks, and foreign trade for 1947 and preceding four years.

Collective Bargaining Provisions: Incentive Wage Provisions; Time Studies and Standards of Production. Bureau of

MERCER BAND Filters
FILTRATION · WASHING · DRYING

Low-cost Efficient Continuous Suction Process


Model No. 50 Mercer Filter

WRITE FOR MERCER FILTERS BULLETIN No. 70

PERFORMANCE—PROVEN FEATURES
Multiple washing zones. Evenly formed filtered cake. Varied thicknesses. Automatic cake discharge. Continuous filter medium cleansing. Low power consumption.

Arrange for Test
Mercer plant is equipped to conduct and report upon experimental tests made with samples of your materials. Inquire about this service.

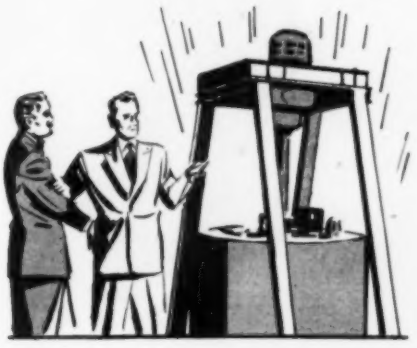
"The Name that Carries Weight"

MERCER ENGINEERING WORKS, INC.
REPRESENTED BY MERCER-ROBINSON COMPANY, INC.
30 CHURCH STREET, NEW YORK 7, N. Y.

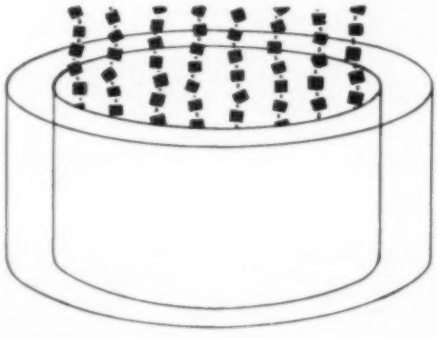
Sales Offices in Principal Cities

"My Plant Stunk!"

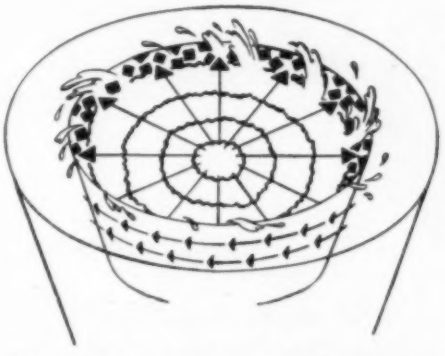
In processing animal food, protein was extracted from fish scraps by acid treatment in settling tanks. This method wasted time, space and material . . . and the odor was highly offensive . . .



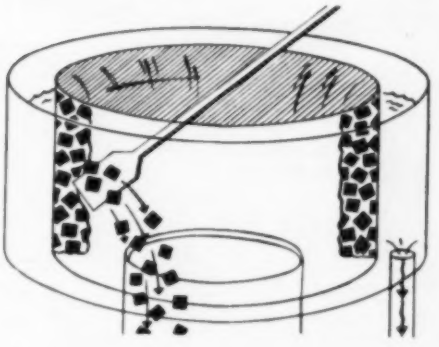
An AT&M engineer solved this problem with a completely enclosed centrifugal having a rubber-covered corrosion-resistant basket.



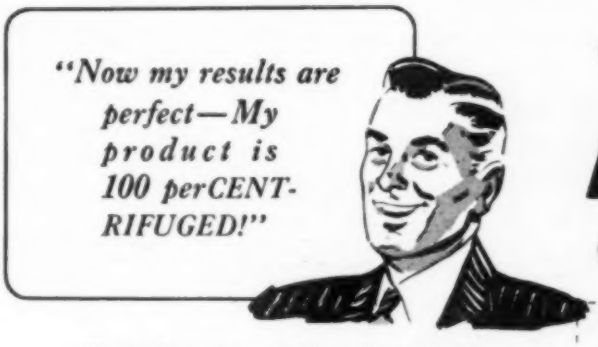
The fish scraps are loaded into the basket with acid added.



When acid has broken down the scrap, centrifugal force whirls the liquid over the basket top, leaving a residue of protein.



Thus converted to a palatable live stock feed, protein is plowed out. Further processing of the effluent and a second cycle yields calcium for poultry feed if desired. Results: Faster processing in less space — waste eliminated — odors eliminated!



SAVE TIME, SPACE AND COSTS WITH

A.T. *and* M. CENTRIFUGING

If you have a problem just mail the coupon — no obligation

Numerous case studies like this offer convincing proof that AT&M centrifuging saves time, space and money. A cost comparison of your present processing methods with centrifuging will gladly be made by our engineers without expense to you. Mail the coupon to AMERICAN TOOL AND MACHINE COMPANY, 1415 Hyde Park Ave., Boston 36, Mass.; 30A Church Street, New York 7, New York.

AMERICAN TOOL & MACHINE COMPANY
1415 Hyde Park Ave., Boston 36, Mass.

Please send information on centrifuging applied to the following processes:
☐ Extraction ☐ Filtration ☐ Dehydration ☐ Coating ☐ Precipitation
☐ Sedimentation ☐ Impregnation

Write here any other process.....

Name.....

Company.....

Address.....

Round corner construction in Blickman stainless steel processing equipment lowers cleaning time—reduces maintenance costs

when you buy
STAINLESS STEEL PROCESSING EQUIPMENT
get maximum saving in cleaning time

Faster cleaning for your stainless steel vessel means this: you reduce maintenance costs and increase the time your equipment can be kept in productive operation. *Round corner construction* will help you achieve this objective.

Even the best brushes require extra time to clear accumulations gathered in a vessel with square corners. When gummy substances or materials that harden are used, it may be almost impossible to clean them from square corners.

S. Blickman, Inc. has developed the technique of round corner construction to a high degree — providing you with equipment that will clean more quickly — at lower cost.

To get *all* the advantages of stainless steel equipment, consult with us.

S. BLICKMAN, INC. • 611 GREGORY AVENUE • WEEHAWKEN, N. J.

S. BLICKMAN, INC.
Guards Alloys in Fabrication

SEND FOR THIS VALUABLE BOOK

A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."

CORROSION RESISTANT PROCESSING EQUIPMENT

TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

Labor Statistics, Bulletin No. 908-3. Price 20 cents.

Guaranteed Wage Plans in the United States. Bureau of Labor Statistics, Bulletin No. 925. Price 35 cents. Report on the extent and nature of guarantee plans and experience of selected companies.

Tests With Mist Blowers to Control Various Insects. By F. W. Poos, et al. Bureau of Entomology and Plant Quarantine, E-751. Processed. Describes results, primarily with DDT and its solutions.

A Chronological List of Publications on Liquefied-Gas Aerosols. Bureau of Entomology and Plant Quarantine, E-754. Processed. Useful bibliography of recent publications valuable for anyone studying insect control.

Effect on Plants of DDT Applied to Soil for the Destruction of Japanese Beetle Larvae. By Walter E. Fleming. Bureau of Entomology and Plant Quarantine, E-737 revised. Processed. Discusses commercial practice and results obtained by commercial establishments desiring to ship seedling plants in interstate commerce.

United States Government Manual, 1948. Price $1. Describes functions and operations of government departments and independent agencies.

Revenue Revisions, 1947-48, Part 4, Tax-Exempt Organizations (Cooperative Organizations). Price $3. Report of testimony before the Committee on Ways and Means of the House of Representatives, November 4 to 26, 1947, regarding tax-exempt organizations, with particular reference to taxation of cooperative organizations.

Health of Workers Exposed to Sodium Fluoride at Open Hearth Furnaces. Public Health Bulletin No. 299. Price 25 cents.

Workers' Budgets in the United States, City Families and Single Persons, 1946 and 1947. Bureau of Labor Statistics, Bulletin No. 927. Price 25 cents.

Synthetic Organic Chemicals, United States Production and Sales, 1947. U. S. Tariff Commission. Preliminary report. Processed. September 1948. Most recent of usual annual series.

Recovery of Lithium From Its Various Ores and Salts. By J. B. Cunningham and C. H. Gorski. Bureau of Mines, Report of Investigations R. I. 4321. Mimeographed.

Making Iron Powder in the Tunnel Kiln. By V. H. Gottschalk. Bureau of Mines, Information Circular I. C. 7473. Mimeographed. Summarizes German practice based on German reports.

Zinc Smelting in the Horizontal Retort Fired with Natural Gas. 1. Development of Firing Schedules. By G. L. Oldright. Bureau of Mines, Report of Investigations R. I. 4333. Mimeographed.

Zinc Smelting in the Horizontal Retort Fired with Natural Gas. 2. General conditions of Combustion Influencing Temperatures. By G. L. Oldright. Bureau of Mines, Report of Investigations R. I. 4334. Mimeographed.

A Combination Cleaning and Dewatering Process for Treating Fine Sizes of Coal. Preliminary Report. By B. W. Gandrud and H. L. Riley. Bureau of Mines, Report of Investigations R. I. 4306. Mimeographed.

A Skull Breaker in a Limestone Quarry. By McHenry Mosier. Bureau of Mines, Information Circular I. C. 7472. Mimeographed.

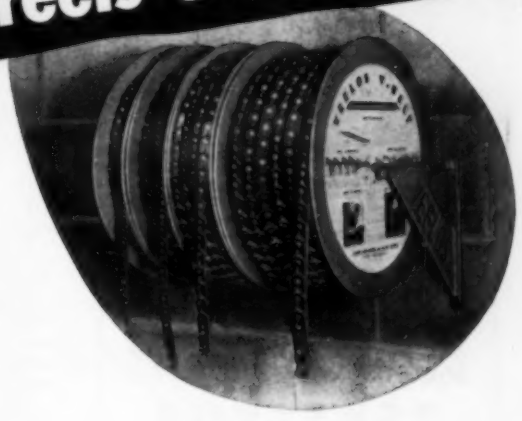
Petroleum Refineries, Including Cracking Plants, in the United States, January 1, 1948. By F. S. Lott, Bureau of Mines, Information Circular I. C. 7483. Mimeographed. Individual plant data and summaries by States and regions.

Breaking Coal with Airdox. By J. S. Malesky. Bureau of Mines, Information Circular I. C. 7480. Mimeographed.

Consumption of Fuel for Production of Electric Energy, 1947. Price 10 cents. Order only from Federal Power Commission, Washington 25, D. C., requesting F. P. C. S-64.

Everyone of these v-belt sizes

can be replaced with 4 reels of Veelos



No matter how big your present V-belt inventory, you can drastically cut it with just 4 reels of Veelos. These handy reels give you a choice of more than 316 sizes in O, A, B and C widths. If you use only A and B sizes, just 2 reels of Veelos will provide you with a complete V-belt inventory. Any length belt is quickly uncoupled from a reel, made endless, then installed.

As soon as you specify Veelos on reels, you can stop stocking matched sets of endless belts. You can forget belt deterioration and obsolescence. Veelos on reels saves storage space . . . simplifies inventory records.

Veelos goes on fast . . . lowers machine downtime. On drives with outboard bearings it is installed without moving the motor or dismantling the machine. Veelos is made in all standard sizes . . . fits all standard grooves . . . is available in 100 foot reels. Sales engineers in principal cities; over 300 distributors throughout the country.

VEELOS
THE LINK
V-BELT

New Veelos Catalog... How Veelos on reels makes big V-belt inventories little is just one of the many features in the new Veelos catalog. All the facts and full engineering data are given. Write for your copy today.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PENNSYLVANIA

VEELOS is known as VEELINK outside of the United States

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

FILTER CLOTH

FOR CORROSIVE LIQUIDS

Write us regarding
New Acid and Alkali-proof
FILTER FABRICS

"DURAKLAD"
"SARAN"
WOVEN GLASS CLOTHS
NYLON FABRICS

COTTON AND SPECIAL FABRICS
FABRICATED INTO TUBES,
BAGS, ETC., FOR ALL PURPOSES

Write for prices. State size, width, quantity, type of filter used.

ALL KINDS OF
• DUST COLLECTOR BAGS •

WM. W. STANLEY CO., Inc.
401 Broadway, New York 13, N. Y.

PROCESSED
AMOSITE
ASBESTOS
FIBRES

•

FOR FILTRATION,
PLASTIC REINFORCEMENT
AND OTHER
INDUSTRIAL USES

Amosite is an extremely long acid resistant asbestos fibre mined in South Africa. It is especially suitable for filtration and similar processes. Available in various grades and degrees of opening to meet specific requirements.

UNION ASBESTOS
& RUBBER CO.

UNARCO

1821 S. 54th AVE., CICERO, ILL.

MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Readers' Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 181-182.

(Continued from page 182)

company. Included are sample calculations and blank charts for making calculations on actual equipment.

113. Gears. Continental Diamond Fibre Co., Newark, Del.—Bulletin CG8 is an 8-page catalog showing the sizes of the various fiber valves produced by this company. The material used in the production of these gears, which are silent in operation, is a synthetic resin impregnated woven fabric. Specifications and horsepower ratings for the standard gear sizes are included.

114. Chlorinated Rubber. Hercules Powder Co., Wilmington, Del.—A new edition of this company's booklets on Parlon, the company's chlorinated rubber, has been issued. The 44-page booklet shows the properties of the material, and also gives considerable information on the use of the product in paints, enamels, inks, and other coatings.

115. Hard Rubber Equipment. The Lucerne Rubber Co., Trenton, N. J.—This 20-page bulletin gives the specifications of the various types of hard rubber equipment produced by this company. Included are pipe and fittings, valves, and pumps. Other more specialized equipment is also described. Data on the corrosion resistance of hard rubber are included.

116. Pumps. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—8-page Bulletin No. 52B6975 describes the floor-mounted, submerged and side wall mounted coolant circulating pumps produced by this company. Capacities and dimensions of these pumps are included in the bulletin.

117. Attrition Mills. Sprout, Waldron & Co., Muncy, Pa.—An 8-page and two 4-page bulletins describe the double runner attrition mill produced by this company. Applications such as shredding, granulating, and fine pulverizing are described. Specifications for the various sized units are included. Typical production capacity data is given for several materials.

118. Conveyors. Standard Conveyor Co., St. Paul, Minn.—16-page booklet No. 62 gives detailed information on the various types of conveying equipment produced by this company. Among the types of conveying equipment considered are gravity roll and wheel conveyors, supports, portable piling machines, belt conveyors, and horizontal loaders and unloaders.

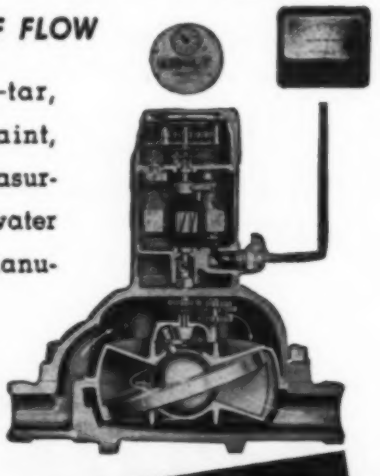
119. Power-House Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—28-page Bulletin No. 05B6107A describes the motors of 1 hp. and larger produced by this company for driving power-house auxiliaries. Among the applications considered are operating boiler feed, condenser circulating water, and condensate pumps, and such other equipment as coal pulverizers, pulverizing exhausters, fans, ash sluices, and coal hoists. A motor selection chart is also included.

120. Oil Vaporizer. Vapofier Corp., Chicago, Ill.—This 4-page bulletin describes the oil vaporizer put out by this company. The vaporizer can be either a primary fuel source for gas-burning equipment, or can be used as a standby

NEW

HAYS Veriflow
TOTALIZING-INDICATING
METER

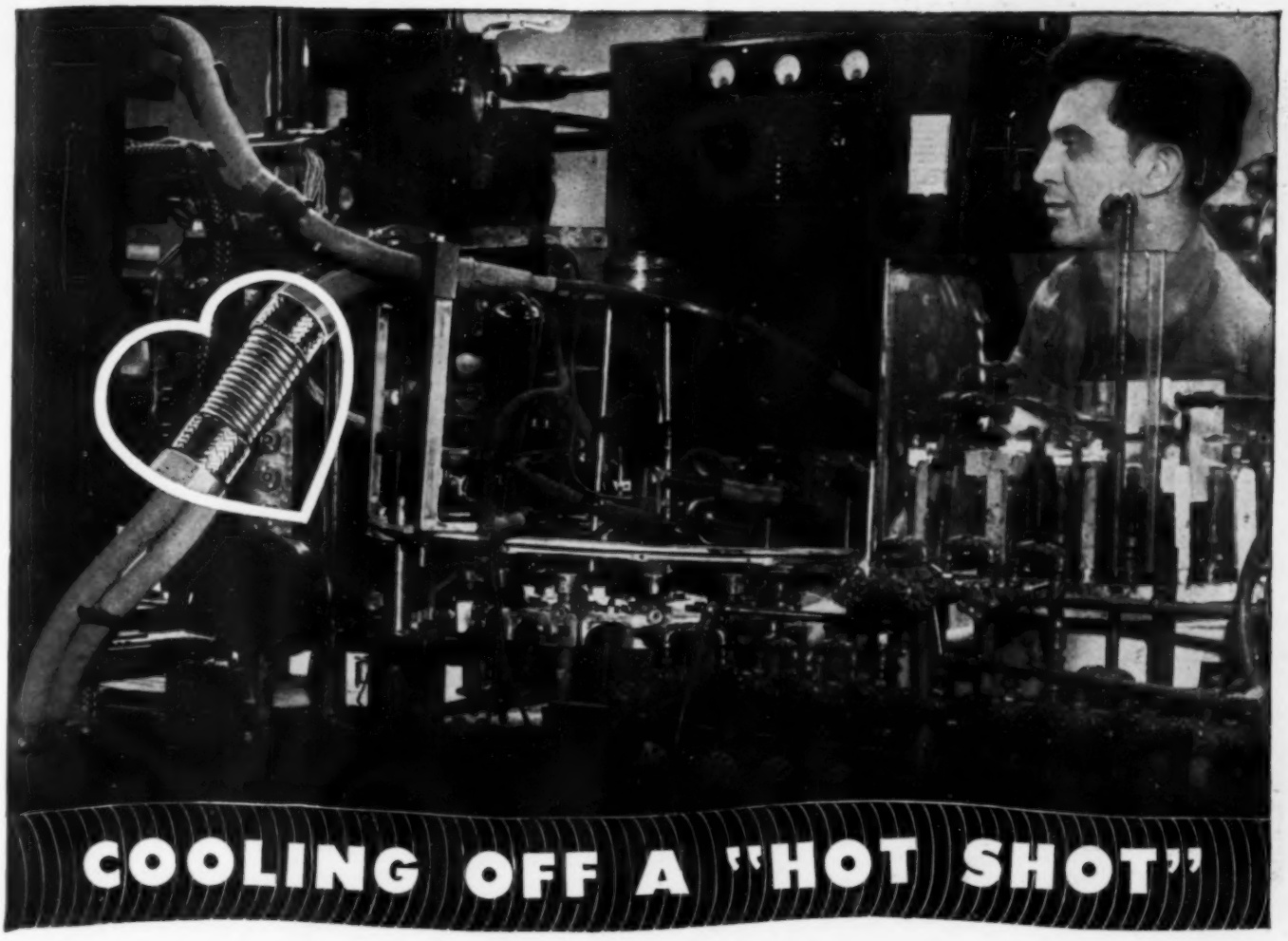
Featuring
REMOTE INDICATION OF RATE OF FLOW



For practically all liquids—tar, molasses, crude oil, grease, paint, varnish, syrups, etc., etc.—for measuring, indicating, totalizing flow of water and chemicals in continuous manufacturing processes and numerous other uses. Its remote indicating feature is new—get the complete story.

SEND FOR BULLETIN. 46-766

The HAYS CORPORATION
Since '91 COMBUSTION & INDUSTRIAL INSTRUMENTS & CONTROL
MICHIGAN CITY, INDIANA, U.S.A.



COOLING OFF A "HOT SHOT"

Penflex "Flexineering" solves problem of conducting and cooling a 3500-volt "shot" in vacuum tube plant.

One well-known vacuum tube manufacturer developed several powerful induction heat "bombarders" for forming the vacuum in radio tubes. A 3500-volt "shot" quickly generates 950°F. in the tubes . . . exhausts the air . . . forms a vacuum, speedily, efficiently.

But—a problem arose. They needed a good conductor to carry the "hot shot" to the machine head—one that could be kept cool, yet remain flexible. Various wiring arrangements and cooling devices were tried but each proved impractical. Then Penflexweld tubing was applied and—the problem vanished!

The copper construction of Penflexweld furnishes an ideal conductor, while cold water circulating through the tubing keeps it cool. Penflexweld flexes easily with constant machine motion. Wrapped rubber insulation protects operators from shock. The higher efficiency developed by the use of Penflexweld eliminated the need for larger and more expensive bombarder units.

Penflex "Flexineering" (the science of engineering each type of flexible metallic tubing to the particular problem) can help solve similar problems on production, maintenance, and product design in your plant. For helpful engineering service and a complete line of metallic hose and tubing from ⅛" I.D. to 30" I.D. in all types . . . for all uses . . . call on Penflex. Write today for additional data on the above case history.

PENNSYLVANIA FLEXIBLE METALLIC TUBING COMPANY

7234 POWERS LANE — PHILADELPHIA 42, PA.

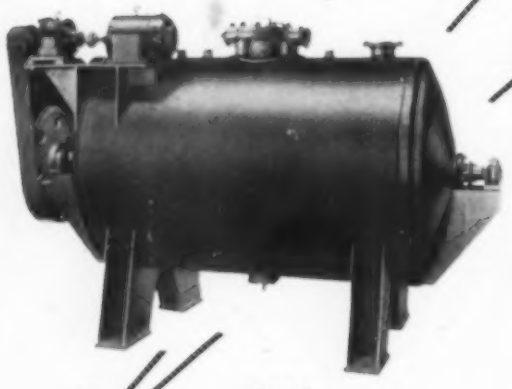
BRANCH SALES OFFICES • BOSTON • NEW YORK • CLEVELAND • CHICAGO • HOUSTON • LOS ANGELES

Penflex... HEART OF INDUSTRY'S LIFE LINES

Copyright 1948

I·P·E MIXERS

"Standard-Plus" Units expertly engineered to your mixing needs.



I*P*E HORIZONTAL MIXER with double ribbon agitator.

I*P*E "Standard-Plus" Mixer Line

BATCH AND CONTINUOUS LIQUID MIXERS
★
REDUCING MIXERS
★
HORIZONTAL DRY OR WET MIXERS
★
PASTE MIXERS
★
PAINT MIXERS
★
DOUGH MIXERS
★
CONICAL DRY MIXERS

I*P*E "Standard-Plus" Mixers are a step beyond the standard line of mixers. For "Plus" value, they embody added features to meet individual mixing needs. Every I*P*E Mixer is functionally "tailor made" for exacting requirements.

The units combine the results of wide experience of **I*P*E's** engineers in the process industries with sound engineering, expert design and precision manufacturing.

Whether your mixing problem calls for the blending of liquids, liquids and solids, slurries, pastes, plastics, doughs and dry powders, you will find an I*P*E model that will do the job for you as you want it done.

*For every I*P*E "Standard-Plus" Mixer, special consideration is given to the best type and speed of agitation.*

*Other I*P*E "Standard-Plus" Processing Equipment* — **Kettles • reactors dissolvers • stills • crutchers • extruders • nitrators • sulfonators crystallizers • all types of agitators • pony mixers • change can mixers**

SPECIAL UNITS AND COMPLETE PLANTS

I*P*E staff of process plant engineers and designers welcome your inquiry for special needs. No obligation.

Send for our complete catalogue

INDUSTRIAL PROCESS ENGINEERS

—ENGINEERS
—DESIGNERS
—MANUFACTURERS

5200 HUDSON AVENUE, WEST NEW YORK, N. J.
Branch Offices: Chicago, Cincinnati St. Louis, Pittsburgh

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

in case of gas supply failure. Applications are discussed and standard unit sizes are listed.

121. Furnaces. Denver Fire Clay Co., Denver, Colo.—24-page catalog lists the various types of furnaces manufactured by this company. Included are forge, melting, heat treating, laboratory and testing, assay, and special furnaces and ceramic pottery kilns.

122. Crushers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—16-page Bulletin No. 07B6369B describes the construction features of the A-1 jaw crusher. The unit is recommended for crushing tough, abrasive, high compressive strength materials. The bulletin gives sizes and principal dimensions of the unit, as well as capacities.

123. Fans. De Bothezat Fan Division, American Machine & Metals, Inc., East Moline, Ill.—Three new catalogs describe the axial-flow fans, roof ventilators, and exhausters produced by this company. The catalogs contain specifications, dimension drawings, and capacities of the various units.

124. Centrifuges. Tolhurst Centrifugals Division, American Machine & Metals, Inc., East Moline, Ill.—This 16-page bulletin gives data on the centrifuges produced by this company, sizes ranging from 12 to 48 in. in diameter. Both motor-driven and hydraulically-driven units are included. Specifications and dimensions are given.

125. Valves. Kinney Manufacturing Co., Boston, Mass. 4-page Bulletin No. 2448 gives data on the vacuum type valves produced by this company. These valves are made in sizes from 1¼ to 4 in., and are either of cast steel or bronze.

126. Rotameters. Schutte & Koerting Co., Philadelphia, Pa. 4-page Bulletin 18-RA describes the various types of rotameters manufactured by this company. Included are not only instruments which are gaged visually, but also recording rotameters.

127. Benzene Hexachloride. John Powell & Co., New York—This 9-page brochure gives chemical and physical data on benzene hexachloride. The bulletin also gives information on toxicity, effectiveness against various insects, directions for use against different insects, and full labeling instructions.

128. Fans. National Association of Fan Manufacturers, Detroit, Mich.—4-page Form X-12 gives the physical proportions of various commercial fans produced in this country. The data includes the fans produced by ten different manufacturing companies. Included are multiblade and non-overloading fans, as well as industrial fans.

129. Cooling Towers. The Marley Co., Kansas City, Kans.—4-page Bulletin G-48 gives a brief description of the types of cooling towers produced by this company. The special features of these towers are outlined, and applications are mentioned.

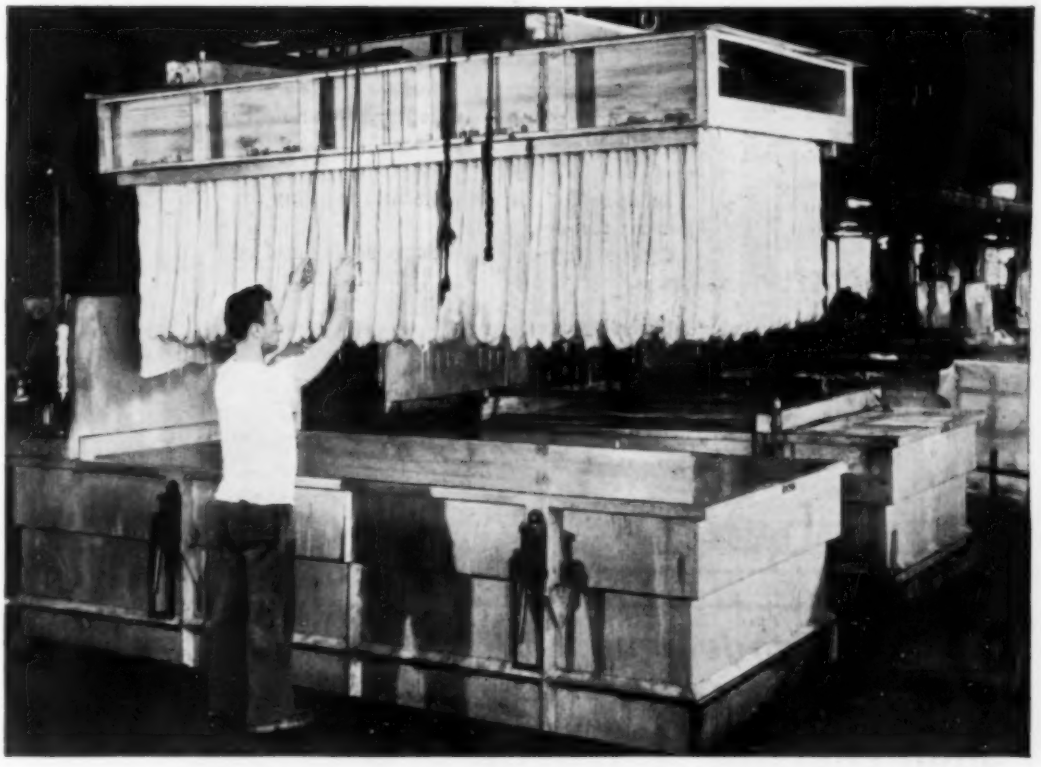
130. Inert Gas. C. M. Kemp Mfg. Co., Baltimore, Md.—8-page booklet describes sizes and specifications for inert gas production equipment manufactured by this company. A flowsheet of the process used is included.

131. Chemicals. Chemical Division, Koppers Co., Pittsburgh, Pa.—6-page Bulletin C-8-103 lists all the chemical products offered for sale by this company. The bulletin gives the structural formula of each chemical and a brief description of the product, its reactions, and uses.

132. Fork Trucks. Wright Hibbard, Industrial Electric Truck Co., Phelps, N. Y.—This 8-page bulletin describes the

"STAINLESS STEEL holds colors 'true'..."

—say yarn dyers



Shades can be changed rapidly in these all-stainless steel yarn dyeing machines with no effect on brightness of color. Tanks, covers, racks and dye sticks all are stainless steel. Other uses for ENDURO include cans, reels, saturators, bleaching equipment, continuous dyeing equipment, hosiery forms and many more.

● Delicate colors consistently come right and bright from dyeing equipment made of Republic ENDURO Stainless Steel. Shades are identical with those developed under laboratory conditions, because ENDURO offers a natural immunity to dye bath chemicals and bleaches.

Moreover, changes from dark to light shades can be made lightning-fast with no danger of color carry-over—because ENDURO is so easy to clean . . . quickly and *completely.* Its remarkable resistance to rust and corrosion forestalls any chance of color spoilage from those sources. And, it needs no plating, painting or other protective coating . . . it's solid stainless steel all the way through.

Throughout the textile, chemical, pharmaceutical and food industries, these same values of ENDURO Stainless and Heat-Resisting Steels are improving processes and protecting product quality in an infinite variety of applications. Ask your equipment fabricator, or write us for full information.

REPUBLIC STEEL CORPORATION

Alloy Steel Division • *Massillon, Ohio*

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Department: Chrysler Building, New York 17, New York

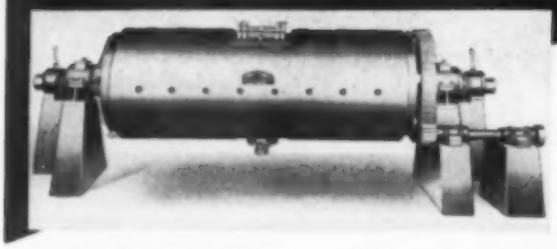
REPUBLIC STEEL

Enduro Reg. U. S. Pat. Off. **STAINLESS STEEL**

RESISTANT TO RUST AND CORROSION • RESISTANT TO HEAT • HIGH IN STRENGTH • EASY TO FABRICATE
EASY TO CLEAN • FREE FROM CONTAMINATION • EYE APPEALING • LONG LASTING • LOW ULTIMATE COST

A PRODUCT OF REPUBLIC STEEL

One of Hundreds of Mills Manufactured by



Paul O. Abbé OF LITTLE FALLS, NEW JERSEY

PAUL. O. ABBE PRODUCTS:

- All steel ball and pebble mills.
- Dry and paste mixers.
- Burrstone and porcelain linings.
- Porcelain and steel balls.
- Imported selected flint pebbles.

JACKETED TUBE MILLS

like that illustrated are used for grinding aluminum, bronze and other metalic products; shell is of chrome manganese steel and steel balls are used for grinding.

Recommended for other products requiring temperature control.

Can be equipped for continous feeding and discharge.

Whatever your industrial grinding or mixing needs, you can have a Paul O. Abbe machine, designed and constructed under the supervision of one of the country's leading authorities on grinding and mixing processes.

Send for complete catalogs of Paul O. Abbe equipment, illustrating and describing hundreds of Paul O. Abbe machines, parts, supplies, etc.

PAUL O. ABBE

375 CENTER AVENUE
LITTLE FALLS, NEW JERSEY

How the fundamentals of chemistry, physics and engineering apply to HIGH-POLYMER MATERIALS

A thorough discussion and explanation of the underlying principles and concepts applicable to all materials of high molecular weight—paints, plastics, rubbers, leather, textiles, paper, wood products, etc.

This book gives you a keen understanding of the formation, properties, manufacture, development, fabrication and application of high-polymer materials—provides not only *techniques* and *methods* but reference material of value in research, development, and application of products.

PRINCIPLES OF HIGH-POLYMER THEORY AND PRACTICE

By Alois X. Schmidt,
Assistant Professor in Chemical Engineering,
and Charles A. Marlies,
Associate Professor in Chemical Engineering, College of the City of New York

You get reliable information on materials of high molecular weight—their solubility, elastic deformation, flow, molding and manipulation, mechanical properties, electrical, thermal and optical properties. The book discusses resin product development and surface coating and adhesives . . . provides tabulated data, as well as almost three-hundred valuable charts, graphs, photographs and drawings . . . brings you an unusually broad discussion of *basic principles*.

CONTENTS

1. Introductory Definitions and Concepts
2. Molecular Forces
3. Some Special Behaviors and Properties of High Polymers
4. Polymer Formation and Modification
5. Structures of High Polymers
6. Solubility and Molecular-weight Relations
7. Rheology
8. Molding and Manipulation
9. Mechanical Properties
10. Electrical, Thermal and Optical Properties
11. Fibers and Fibrous Products
12. Rubbers
13. Rubbers (Continued)
14. Surface Coatings
15. Adhesives
16. Resin Product Development; Phenolic Resins

714 *pages*, 268 *illust's.*, 121 *tables*, $7.50

SEE IT 10 DAYS FREE—MAIL COUPON

McGraw-Hill Book Company
330 West 42nd Street, New York 18

Please send me a copy of Schmidt's and Marlies' PRINCIPLES OF HIGH-POLYMER THEORY AND PRACTICE for 10 days' examination on approval. In 10 days I will remit $7.50, plus a few cents postage, or return the book postpaid.*

Name .....
Address .....
City ..... State .....
Company .....
Position CE-11-48

*Save! We pay postage and packing charges if you send cash with your order. Same return privilege.

specifications and sizes of the fork trucks produced by this company. The applications and capacities of these trucks are included.

133. Motors. Electric Machinery Mfg. Co., Minneapolis, Minn.—Two new bulletins, 4-page Bulletin No. 1200-PRD-175, and 8-page Bulletin 1100-PRD-181, describe the various types of synchronous motors produced by this company. The first bulletin covers low-speed motors which operate below 500 rpm., and the second bulletin covers high-speed units which operate above 500 rpm. Construction features are illustrated.

134. Condensate Return. Cochrane Corp., Philadelphia, Pa.—4-page publication No. 3250-1 describes the high-pressure condensate return system advocated by this company. Specifications and capacity ratings are given for the six different sizes of units available. Variations in capacity of the unit, due to differences in pressure differential, are also shown.

135. Pneumatic Conveyors. Morse Boulger Destructor Co., New York.—4-page Bulletin No. 312 describes the air activation unit produced by this company, and its use in the pneumatic conveying of pulverized materials. Typical materials conveyed and advantages of this system are outlined.

136. Oil Standby Equipment. Surface Combustion Corp., Toledo, Ohio—8-page Technical Bulletin No. SC139 describes the oil standby equipment produced by this company to convert existing gas burners over to operation on fuel oil during periods of gas shortage. Methods of installation, including instrumentation, are shown. Illustrations of actual installations show how the equipment is used.

137. Motors. Electric Machinery Mfg. Co., Minneapolis, Minn.—Two 6- and 8-page bulletins cover the squirrel-cage induction motors produced by this company. Methods of construction and the various standard sizes are shown, together with their specifications and dimensions. Bulletin 1300-PRD-190 covers 2-pole, and Bulletin 1300-PRD-189 covers 4- or more pole motors.

138. Safety Valves. Associated Valve & Engineering Co., Chicago, Ill.—This 4-page bulletin gives a general description of the various types of safety valves produced by this company. List prices of the various types of valves produced are also given.

139. Mixers. Struthers Wells Corp., Titusville, Pa.—This 4-page bulletin describes the heavy-duty intensive mixer produced by this company for use in the processing of rubber, plastic, and linoleum asphalt compositions. The sizes, capacities, and dimensions of the various standard units are listed. Horsepower requirements are also given.

140. Valve Packing. Edward Valves, Inc., East Chicago, Ind.—4-page leaflet, 12-R, describes heat-resisting molded packings for use in cast and forged steel valves. Prices are included.

141. Turbine Vane Pumps. Peerless Pump Div., Food Machinery Corp., Los Angeles, Calif.—Bulletin B-2200 describes the application of turbine vane type pumps to the handling of liquefied petroleum gases.

142. Electric Motors. Lima Electric Motor Co., Lima, O.—6-page Bulletin MB-1 describes the line of electric motors produced by this company, including drip-proof, totally-inclosed, and explosion-proof motors.

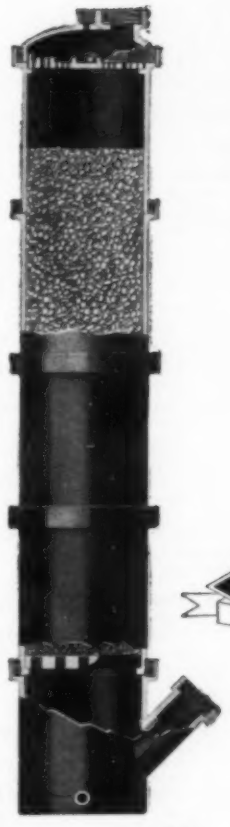
143. Boiler Walls. The G. P. Reintjes Co., Kansas City, Mo.—4-page Bulletin No. 748 illustrates the methods this company has developed to design air-tight refractory inclosures for modern water-walled boilers. The bulletin describes various problems which may be faced in floating wall construction, and gives solutions to them.

144. Plasticizer. Monsanto Chemical Co., St. Louis, Mo.—12-page Technical Bulletin No. P-104 gives the properties and suggested uses of the plasticizer, HD-40. The product is a partially hydrogenated mixture of isomeric terphenyls.

145. Di-Tert-Butyl-Meta-Cresol. Koppers Co., Pittsburgh, Pa.—8-page Technical Bulletin C-8-114 outlines the properties, reactions, and suggested uses for this

General Ceramics Chemical Stoneware

TOWERS are CORROSION-PROOF



(except against hydrofluoric acid and strong, hot caustic)

IF YOU HANDLE . . .

Hydrochloric Acid • **Nitric Acid** • **Sulphuric Acid** • or any other strong corrosive agent in your absorption or reaction process . . . use General Ceramics Chemical Stoneware Towers. They're strong — they're corrosion-proof — they're long lasting. Three types are available.

1. Bell and Spigot Towers for bringing gases, at or near normal pressures in contact with liquids for purposes of absorption or reaction.
2. Flanged Chemical Stoneware Towers for higher pressures.
3. Armored Stoneware Towers for severe conditions of temperature and pressure. (Made to order).

For complete information on corrosion-proof towers, write for

BULLETIN HA and B-2777

Chemical Stoneware is your answer to any corrosion problem in processing operations. Ask a General Ceramics engineer to call.

General Ceramics AND STEATITE CORP.

CHEMICAL EQUIPMENT DIVISION • KEASBEY, NEW JERSEY

BUFFALO: 220 Delaware Ave.
CHICAGO: 20 N. Wacker Drive
LOS ANGELES: 415 So. Central Ave.
PITTSBURGH: 412 Peoples Gas Bldg.
PORTLAND 5, ORE: 410 New Fliedner Bldg.
SAN FRANCISCO: 598 Monadnock Bldg.
SEATTLE: 1411 Fourth Ave.
TACOMA: 417 Tacoma Bldg.
MONTREAL: Canada Cement Bldg.
TORONTO: Richardson Agencies, Ltd., 454 King St., West
VANCOUVER, B. C.: Willard Equipment Ltd., 860 Beach Ave.

4292

In addition to the manufacturing facilities of the Chemical Equipment Division those of the Insulator Division are also available for handling ceramic problems in all branches of industry. General Ceramics & Steatite Corporation is therefore able to offer service covering all industrial applications of ceramic products.

The Solvay soda process was commercially perfected in 1864. Ten years earlier, the first "Roots" Blower was produced. We're not good because we're old, but old because we're good.

MOVING! MIXING!
We give Chemicals a ride
MEASURING!

You gain an important, exclusive advantage, when you work with Roots-Connersville engineers on gas or air-handling problems, and in the moving and mixing of solids by pneumatic conveying.

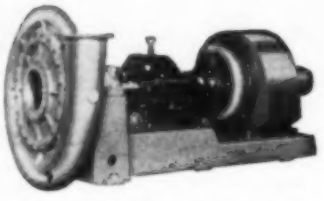
Because we build both Centrifugal or Rotary Positive equipment, we can recommend, without bias, the type best fitted to your needs. Only Roots-Connersville offers you this *dual-ability*.

R-C Centrifugal units incorporate the advanced thinking of skilled, ingenious engineers experienced in the unique needs of the chemical industry.

R-C Rotary Positive Blowers, Meters and Vacuum Pumps are the products of almost a century of blower building. Their simplicity, durability and dependable performance have been long-proved in almost every industry.

You'll find it profitable to move, mix and measure with R-C equipment.

ROOTS-CONNERSVILLE BLOWER CORPORATION
811 Illinois Avenue Connersville, Indiana



From our standard lines of Centrifugal and Rotary Positive Blowers, capacities are available from 5 CFM up.

Rotary Positive Meters measure gases with cash-register accuracy, from 1,000 CFH to 1,000,000 CFH.

ROOTS-CONNERSVILLE
ROTARY CENTRIFUGAL
BLOWER BUILDERS R-C SINCE 1854
BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

• • ONE OF THE DRESSER INDUSTRIES • •

FOR MORE INFORMATION
See Reader Service Coupon on pages 181-182

chemical. Commercial information on containers and handling conditions is included.

146. Stainless Fittings. Taylor Forge & Pipe Work, Chicago, Ill.—4-page Bulletin No. 83 gives dimensions and prices of new type stainless fittings and flanges.

147. Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Two 4-page bulletins describe single-stage horizontal elbow propeller pumps, for high capacity, low heat acid-resisting service and cup-type piston packing.

148. Rotameter. Brooks Rotameter Co., Lansdale, Pa.—2-page bulletin describes the multi-range rotameter produced by this company. Applications are for laboratories and pilot plants.

149. Fume Duct Lining. Ceilcote Co., Cleveland, Ohio.—2-page bulletin describes the acid, alkali and salt-resistant lining for metal or wood produced by this company. Chemicals to which these materials are resistant are listed.

150. Fork Lift Truck Guide. Towmotor Corp., Cleveland, Ohio—A new and revived edition of the Fork Lift Truck "Operator's Guide" has been published. The guide presents operating hints and instructions, together with sections on accessories and their operation.

151. Heat Exchangers. Ross Heater & Mfg. Co., Buffalo, N. Y.—6-page Bulletin describes the shell and tube heat exchangers and allied equipment produced by this company.

152. Ion Exchange. Resinous Products & Chemical Co., Philadelphia, Pa.—24-page special edition of "The Resinous Reporter" entirely given over to information on the ion exchange process, and the resins produced by this company. A detailed bibliography is included.

153. Lignin. Industrial Chemical Sales, New York—32-page Bulletin L-5 gives data on the chemical properties of the various types of lignin produced by this company. The booklet further outlines possible uses of the product and gives a complete bibliography on each suggested application.

154. Feeders. Fuller Co., Catasauqua, Pa.—8-page Bulletin F-3 describes the rotory feeders and rotary valves produced by this company. Sizes and capacities for the various units produced are given, together with recommended speeds and installed horsepower. Suggested applications are included.

155. Insulation Protection. Bitucote Products, St. Louis, Mo.—2-page bulletin illustrates the use of this company's Protektite for use in protecting insulation. The material is an asbestos-fibrated, emulsified asphalt in mastic form.

156. Construction Materials. Fischer & Porter Co., Hatboro, Pa.—4-page Bulletin No. 97 lists materials which may be used for the construction of the Flowrator instruments produced by this company to withstand the corrosive effects of some 400 different materials.

157. Corrosion Resisting Allays. The Duriron Co., Dayton, Ohio—8-page Bulletin No. 114 gives corrosion resistance data on the nickel-molybdenum and nickel-molybdenum chromium alloys produced by this company. Particular attention is given to the resistance of these alloys, Chlorimet 2 and 3, to sulphuric acid, hydrochloric acid, and salt solutions.

158. Bagging Equipment. International Paper Co., New York.—This 8-page folder describes the complete line of machines put out by this company for closing multiwall paper bags. Capacities of these machines range up to fifteen bags per minute.

Fighting Double Corrosion with Duplex Tubing

One of the most troublesome corrosion problems occurs when tubing is attacked simultaneously inside and outside by two entirely different types of corrosive media.

Such corrosion is especially severe in petroleum refineries, petro-chemical and chemical plants, and in ammonia refrigeration systems. In many cases, Bridgeport's Duplex Tubing is helping reduce corrosion which causes loss of production, extra maintenance and hazards, as well as possible contamination of refined and semi-refined products due to failure of tubing or pipe lines.

Duplex Tubing Combinations—Copper, Admiralty, Muntz, Aluminum Brass, Aluminum Bronze or Cupro Nickel with steel, stainless, aluminum, monel or nickel either inside or outside. Duplex Tubing is generally made in condenser tube sizes. Information about other sizes supplied on request.

Applications—An important application for Duplex Tubing is in ammonia refrigeration. Combinations made up of steel tubing to the ammonia side and copper or a copper-base alloy to the water or brine side are outlasting steel tubing, which withstands the ammonia vapor but quickly rusts away on the water side. Experience has shown that Duplex Tubing for this application and for handling other nitrogen compounds has greatly increased tube life and made possible less frequent cleaning and replacement.

SOME OTHER APPLICATIONS

Application	*Tube Components*	*Products in Contact*
Ammonia Liquor	outer—steel inner—copper	ammonia—liquor treated river water
Formaldehyde	outer—aluminum inner—copper	formaldehyde water
Acetic Acid	outer—aluminum inner—copper	acetic acid water
Hydrocarbon Vapor	outer—arsenical admiralty inner—steel	water hydrocarbon vapor
Plastics	outer—arsenical admiralty inner—aluminum	water raw materials for plastics
Amino Compounds	outer—copper inner—steel	water nitrogen compounds
Soap Solution	outer—steel inner—arsenical admiralty	soap solution water
Beer Cooler	outer—copper inner—steel	beer refrigerant
Edible Oils	outer—aluminum inner—arsenical admiralty	food products water
Carbonated Liquid	outer—aluminum inner—copper	carbonated liquid water

In the manufacture of dyes, soaps and drugs, as well as in food processing, Bridgeport Duplex Tubing has been used for the prevention of taste or color contamination of the product.

Heat Transfer—Duplex Tubing of steel and copper has better heat transfer than a single-walled steel tube alone. Corrosion products of copper-base alloys are thinner and interfere less with heat transfer than the heat-insulating scales which accumulate on most ferrous metals. Bridgeport's method of manufacture produces a close mechanical bond between the tubes and makes possible the large number of Duplex Tubing combinations available. *Tests made under carefully controlled conditions show that the mechanical bond does not interfere with heat transfer.*

Vertical Shell and Tube Condenser — Single Pass open type for Ice Making and Refrigeration, courtesy of York Corp., York, Pa.

Mechanical Applications—There are a number of Duplex Tubing Applications being investigated where advantage can be taken of the mechanical properties of steel and the corrosion-resistance of copper-base alloys. Duplex Tubing has been used for pump liners with steel on the outside and brass on the inside, as well as for high pressure lines in the chemical industry.

Installation—Duplex Tubing can be expanded or rolled into tube sheets in the same way as ordinary condenser or heat exchanger tubing, except that more care and effort are necessary because it is stiffer than single-walled tubing. Write for Duplex Tubing Bulletin No. 746 which contains detailed information about installation methods.

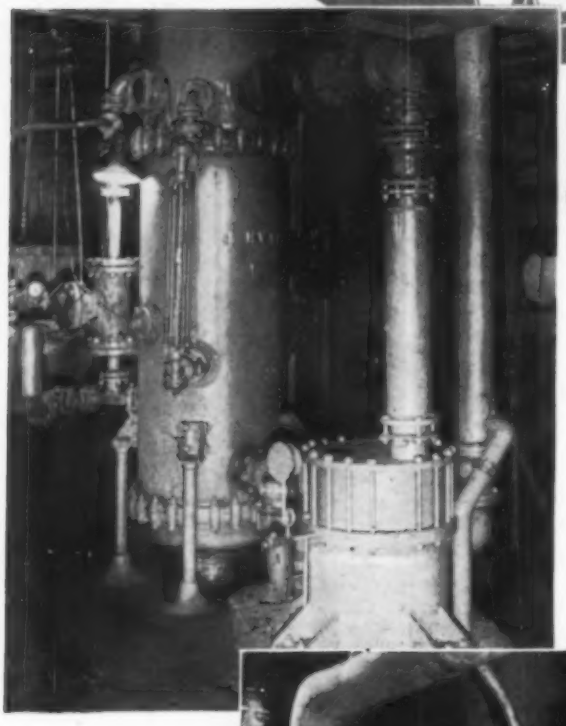
Bridgeport's Corrosion Laboratory is set up to help solve difficult corrosion problems involving tubing. Contact the nearest Bridgeport office for this service.

"Bridgeport" BRASS CO.

BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • *Established 1865*
Mills at Bridgeport, Connecticut, and Indianapolis, Indiana
In Canada—Noranda Copper and Brass Limited, Montreal

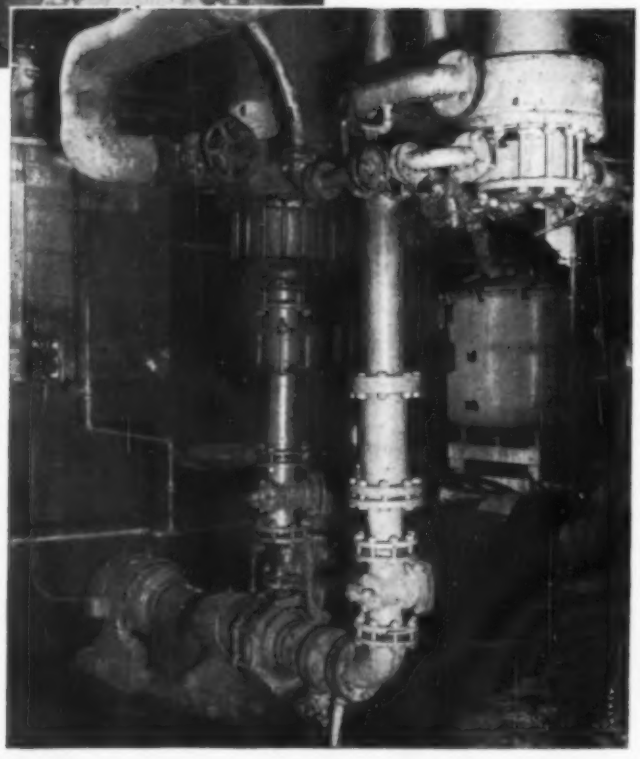
CONDENSER AND HEAT EXCHANGER TUBING

Struthers Wells



EVAPORATORS

SOLVE DIFFICULT CORROSION PROBLEMS THROUGH HIGHLY ADVANCED ENGINEERING AND UNEXCELLED PLANT FACILITIES



The evaporator shown was needed for handling a highly corrosive acid solution, which could be handled satisfactorily by no single metal or alloy.

Struthers Wells combined the use of glass lined steel, "Karbate" Impervious graphite, high alloy castings, "Haveg," and rubber lined steel to produce a highly satisfactory pump recirculation type evaporator.

When you have a tricky evaporating problem, call on Struthers Wells to provide a sound, economical design which can be adapted to the use of the best possible materials of construction at the points for which they are best suited.

If the solution handled has unknown characteristics, tests can be made in Struthers Wells experimental laboratory to be sure that design is fully adequate for any unusual foaming, scaling, or heat sensitive characteristics.

Write for informative, technical bulletins.

Struthers Wells

STRUTHERS WELLS CORPORATION
PROCESS EQUIPMENT DEPARTMENT
WARREN, PENNA.
PLANTS AT WARREN, PA. and TITUSVILLE, PA.

CHEMICAL ECONOMICS

Richard F. Warren, ASSISTANT EDITOR

Record Chemical Consumption Indicated As End of Year Approaches

This will be the best year that chemical process industries have seen, if physical volume of output is used to measure prosperity. While complete data are not available, preliminary information shows that we are well above last year in many lines and that the parts of the process industries that are below last year's operating rates are small when compared with those which are rolling along above 1947 levels.

For example, soda ash is a chemical which is used in many process industries. This chemical has been in short supply for the past few years, but the completion of expansion programs has increased production to a current annual rate of 5.15 million tons. This is more than 600,000 tons above the 1946 operating capacity. Such increases in productive capacity have allowed consumers to expand their use of basic chemicals and in turn increase their output of finished goods.

Consumption of fertilizers is 12 percent above last year, based on nine months chemical fertilizer sales for 1948 and 1947, as reported by the National Fertilizer Association. According to the association, tag sales in September were 35 percent above the corresponding month in 1947.

According to the government, paper and paperboard output will probably reach a record total of almost 22.3 million tons this year. It was pointed out that October production in this industry may exceed all prior monthly records. Much of this gain comes from the operations of large integrated mills. Production in August compared with August 1947 was up 21 percent for shipping sack paper, up 10 percent for kraft wrapping paper, up 21 percent for bag paper, and up 23 percent for liner board. However, output of corrugated board, container chipboard and box board was off slightly.

Solvent producers using fermentation processes have recently benefited from the surplus in potato crops. The government sold such potatoes to fermenters at 15c. per bushel and at least one of the producers, Publicker, is making potato flour under government contract.

The synthetic rubber industry is following the growth of the new cold rubber process with considerable interest. U. S. Rubber Co. is converting 10 percent of the Naugatuck, Conn., plant capacity (30,000 long tons per year) to this process. Success of the product in non-tire uses will probably lead to conversion of a larger part of the plant to production of cold rubber. The new material has already proved successful in tire production.

Total new rubber consumption for the first nine months of this year was 813,403 long tons compared with 828,692 long tons for the same period last year. Natural rubber consumption from January through September was 475,166 long tons, or about 78,000 long tons above January-September 1947 level.

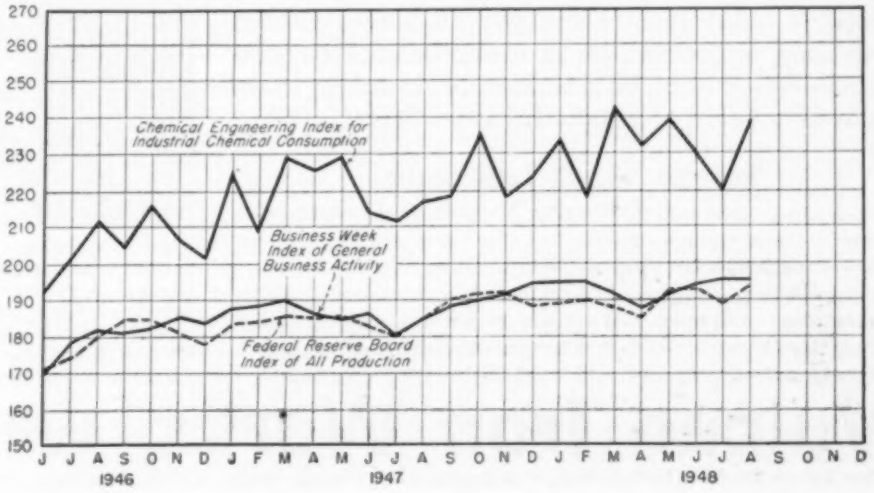
The Bureau of Mines has released some interesting information on the coke-oven industry. At the end of 1947 there were 14,728 operable coke-ovens in the country. These ovens vary in age—13 percent are over 30 years old, 27 percent are 25-30 years old, and 12 percent range from 20 to 25 years in age. This means that 52 percent of the operable units are older than the generally accepted age limit (20 years) for efficient operations. Since the rated capacity of installed ovens is more than 100 million tons of coal treated per year, experts feel that it would cost $0.9 billion to replace about one-half of the existing capacity. They feel that this is a fair and conservative statement of desirable, though not probable, replacement needs. On top of this figure they also feel that current oven capacity could be further expanded to the extent of another $0.2 billion to satisfy current needs. While no one expects to see modernization occur on such a scale, it is a sound economic yardstick of what would be technically desirable. This is only a small segment of the chemical process industries, but it illustrates the tremendous expense involved in modernizing existing plant capacities.

Chemical Engineering Index

Industrial Consumption of Chemicals

1935 = 100

	July	August
Fertilizers	44.50	50.70
Pulp and paper	22.60	24.60
Petroleum refining	23.08	22.20
Glass	20.60	25.30
Paint and varnish	24.71	26.20
Iron and steel	13.01	12.80
Rayon	27.50	27.40
Textiles	9.62	10.48
Coal products	10.49	10.92
Leather	3.73	4.42
Explosives	9.08	9.45
Rubber	5.01	6.20
Plastics	7.15	7.50
INDEX	221.08	238.17



Although designed to suit the particular operating conditions and requirements involved, this kiln is of standard Vulcan all-welded construction, properly reinforced at points of greatest strain. The two cast-steel tires are mounted on the shell by a distinctive method which has proved its superiority in overcoming the usual tendency toward burning or bulging at these vital points. The cast-steel gear ring and main pinion have machine-cut teeth and both are completely enclosed in an oil-tight safety guard. The motor-driven speed-reducer drive-unit operating in an oil bath, and the modern two-roller-type supporting bearings, assure smooth rotation at minimum operating expense.

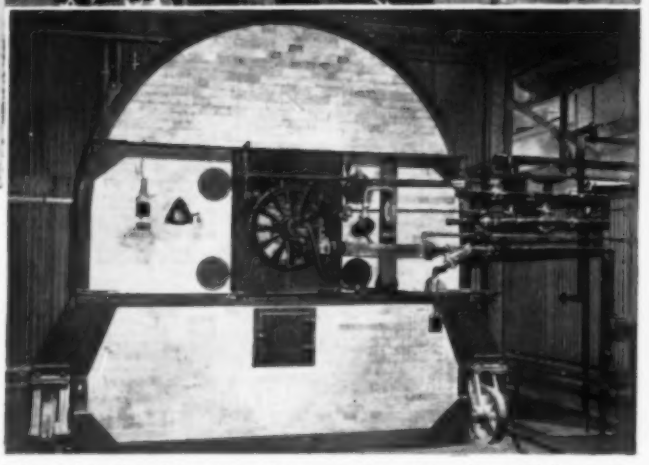
Another
VULCAN ROTARY KILN
in a modern paper mill

Recovery of lime from paper-mill sludge is only one of many ways in which Vulcan Rotary Kilns, Coolers, Dryers, Retorts, Pelletizers, etc., are cutting costs for the chemical processing, metallurgical and rock products industries.

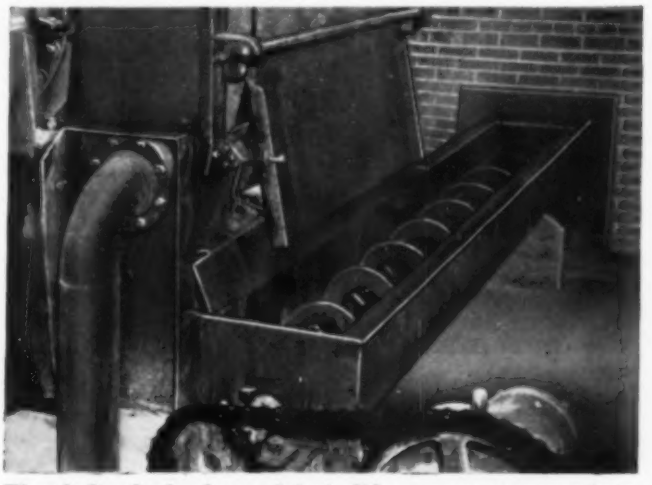
Materials and processes to which Vulcan equipment is now being applied include the nodulizing and pelletizing of fine wet ore, desulphurizing of ore, dehydration of bauxite and many other minerals, alteration of barytes, calcining of lithopone, calcining of titanium dioxide, etc. In practically all cases these various types of rotary cylinders are designed especially to meet the purchaser's requirements and our engineers always welcome opportunities to make helpful suggestions—based upon data accumulated during more than fifty years of successful experience.

Bulletin 442-C Tells More

—not about processing methods, because that would require a thick volume, but its 28 fully-illustrated pages are packed with specific information regarding Vulcan Rotary Kilns, Coolers, Dryers, Briquetting Machines and other processing equipment. We want every engineering and productive executive who can use this booklet to advantage to have a free copy and will mail it promptly on request.



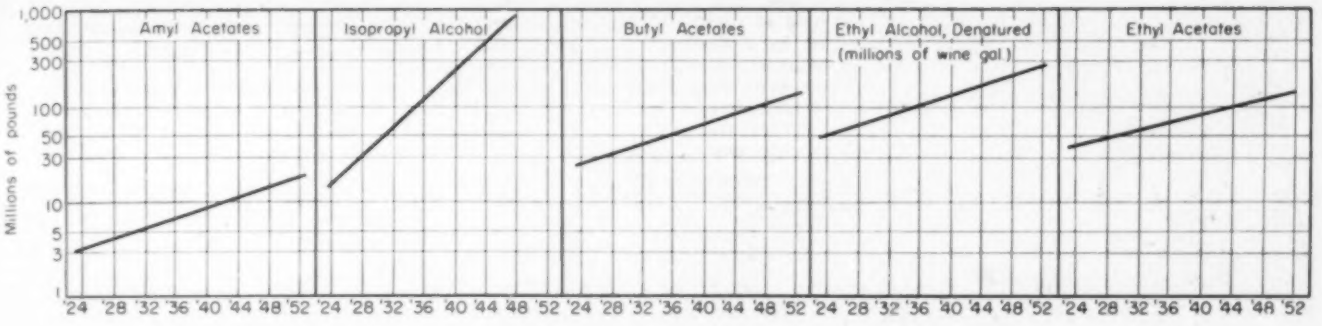
The firing hood is one of a number of modern Vulcan designs—modified, in this case, for the burning of natural gas. In this design the entire firing hood is mounted on wheels but we also offer stationary firing hoods and a variety of special features to meet specific requirements.



The sludge feeder is our latest ribbon screw-conveyor type, suitable for handling wet or moist materials, and projects through the stack chamber into the kiln—the section exposed to high temperature being water-cooled. Various other methods are employed for feeding material into Vulcan kilns, dryers, retorts, etc., according to operating conditions and requirements.

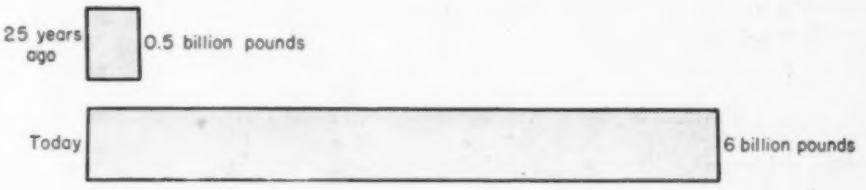
Vulcan Iron Works, Wilkes-Barre, Pa.

Other Vulcan Products include Industrial Locomotives, Electric Hoists, Mining Machinery, Sugar-Mill Machinery, Heavy Special Machinery



Long term production trend lines show big expansion, but output is catching up with current demands

Solvents



THIS month *Chemical Engineering* takes a look at solvents. At a recent Chemical Market Research Association meeting, they were the subject of considerable interest. Therefore we are presenting a summary of growth trends of the solvent industry. To limit the scope of this survey, we will confine our study to the alcohols, esters and ketones and exclude the coal-tar chemicals such as benzene, toluene and xylene as well as the petroleum hydrocarbons.

This gives us a change to examine the growth of the more important solvents such as methanol, ethanol, propyl alcohols, butyl alcohols and amyl alcohols and methyl isobutyl carbinol.

Among the important solvents in the ester classification are the acetates —methyl, ethyl, isopropyl, butyl, and amyl. In the ketones we have acetone, MEK, and MIBK.

Back in 1921 the solvent market had grown to the point that the Tariff Commission, which had been reporting data on coal tars since World War I began to give out data on the "Organic chemicals other than coal-tar." The bulk of these were solvents which had grown rapidly in that war and postwar era. The demand for suitable solvents for the fast drying auto lacquers found butanol waiting to move in. During the first world war, Commercial Solvents had purchased a plant in Terre Haute, Ind., and Peoria, Ill., to produce acetone by the Weizman fermentation process.

In the mid-twenties the synthetic processes began to product solvents in significant quantities. By 1927, fermentors were producing more than 100 tons of solvents per day and were still expanding. In 1923 butyl acetate was only 1.8 million pounds and in 1927 it was up to 27¼ million pounds.

The growth of the automobile industry had created a major solvent market. Not only butanol and its derivatives were helped—ethyl and amyl acetates as well as butyl acetates found a ready market in the protective coatings used in such large quantities in the automobile industries. More organic solvents appeared in the picture in 1924 on a large scale as the halogenated hydrocarbons such as carbon tetrachloride and ethylene dibromide grew rapidly.

Amyl alcohol demand became so large that by 1927 the Sharples Solvent Corp. began production of a synthetic product from pentane and produced 2.4 million pounds in 1927 and 4.5 million pounds in the following year. It was about this time that the glycol ethers also found a large market as lacquer solvents. Use of butyl propionate and glycol derivatives as lacquer solvents grew very rapidly in this period.

Synthetic methanol production was started in the United States in 1927 by two companies and they were joined by a third in 1929. By 1930, the production of synthetic methanol reached 48.9 million pounds and exceeded the output of the wood distillation product.

In this same year, high pressure synthesis of several higher alcohols was introduced on a commercial scale. Acetone production from propylene was reported for the first time in 1930 although production began in 1929.

Having seen what the background of the solvent industry looked like in the 20's let's take a look at it today.

Here we see the twelvefold growth of this industry over the past 25 years. This is really a conservative figure on the current size of the industry. Today, annual production rates of methanol are greater than the total solvent output for 1923. Now we are making almost as much methanol in one month as we got in one year in the early twenties.

At the present time, solvents are being produced at the rate of more than 30 gallons per second, or 6 billion pounds per year.

Today we are in a transitional state as the postwar expansions are nearing completion and the pent up demands are being gradually filled. If we go back to World War I we can find a somewhat similar situation just prior to the slump that followed the wartime boom. However, this time the readjustment will probably be much less severe. Nevertheless, we are still in a period of inflated demand, prices, and exports. Some corrective movements will have to take place before we can say we are in a "normal postwar period." In this period of inflation it is difficult to have complete faith in a trend line. On the other hand, in the case of ethyl alcohol and several other solvents, output would have been much higher had conditions in the industry been more favorable. Prices were abnormal and ethanol was "priced out" of many of its normal markets.

Raw material shortages were one of the major reasons for holding down the rate of production of several solvents. The trend lines shown are based on production and this means that they are affected by two major influences. At the end of the war, inventories were low, and we were faced

Filtrol improves the products now in the public eye

Based on the successful experience of leading American businesses using Filtrol* products, you too may have an opportunity for perfecting present products or processes . . . or advancing your pioneering efforts.

No matter what your business – if it needs or can use catalysts, adsorbents or desiccants, the "know how" of Filtrol process engineers is offered to help you take advantage of scientifically produced Filtrol products to meet your specific needs.

Filtrol Corporation is the world's leading manufacturer of catalysts, highly activated, chemically treated adsorbents and desiccants – all vitally important to the petroleum industry, the fatty oil industry, agricultural insecticides, purification of solvents, and in protective packaging.

Investigate the possibilities offered by Filtrol products and Filtrol processing. Write for technical information today.

FILTROL CORPORATION
General Offices: 634 South Spring Street, Los Angeles 14, California
Plants at Vernon, California and Jackson, Mississippi

Filtrol

Product of Research and Development
*Reg. U.S. Pat. Off.

CATALYSTS • ADSORBENTS • DESICCANTS

with markets that had been on starvation diets during the war.

Both producer and consumer stocks were low and since then, production has been aimed at the twofold purpose of supplying consumer's needs and also allowing consumers to build up adequate stocks.

Eventually the markets will grow to the point where postwar output will be inadequate. In the meantime, what lies ahead?

A poll of several producers and consumers of solvents shows that most of them feel that we are approaching a peak in demand and they base their reasoning on the fact that soft spots are beginning to develop in some lines. However, rayon is one major consumer of solvents that seems headed for bigger and better times in the next few years. And that is a market that accounts for about 60-70 million pounds of acetone and about 225 million pounds of CS_2 per year.

Protective coatings consume about 500 million pounds of solvents in a year. This industry is one in which many solvents are interchangeable and the consumption of individual solvents in this market is therefore bound to fluctuate as prices and availability of solvents suitable for a particular task change. After all, producers of the various formulations want to get the maximum results per dollar spent and will always use the least expensive items that will give a satisfactory job.

During the war we were confronted with a shortage of antifreeze that promises to continue into the current year. This end use of three major items in the solvent industry naturally attracts considerable interest.

At the present time we have a consumption of about 80 million gallons per antifreeze season. This market is estimated to be split as follows: 55 percent, methanol; 15 percent, Ethanol; and 30 percent glycol. This compares with a 1936-37 antifreeze year of about 50 million gal.—distributed as follows: 65 percent, ethanol; 18 percent, methanol; and 18 percent, glycol.

Ethyl gasoline is another major solvent consumer. In the course of a year it probably consumes about 300 million pounds of halogenated solvents.

In addition to these markets there are many others that are important. They include brake fluids (50 million pounds per year, pharmaceuticals (10-20 million pounds per year and petroleum refining (25 million pounds per year).

These industries will all show a continued growth over the next few years—as the building boom continues, automobile output soars, and a rejuvenated defense program gets under way.

Why anything other than a Cylindrical Plug Valve?

It came into being with modern precision-ground fits... High pressure grease seal... Easy to turn... Always liquid tight.

CYLINDRICAL

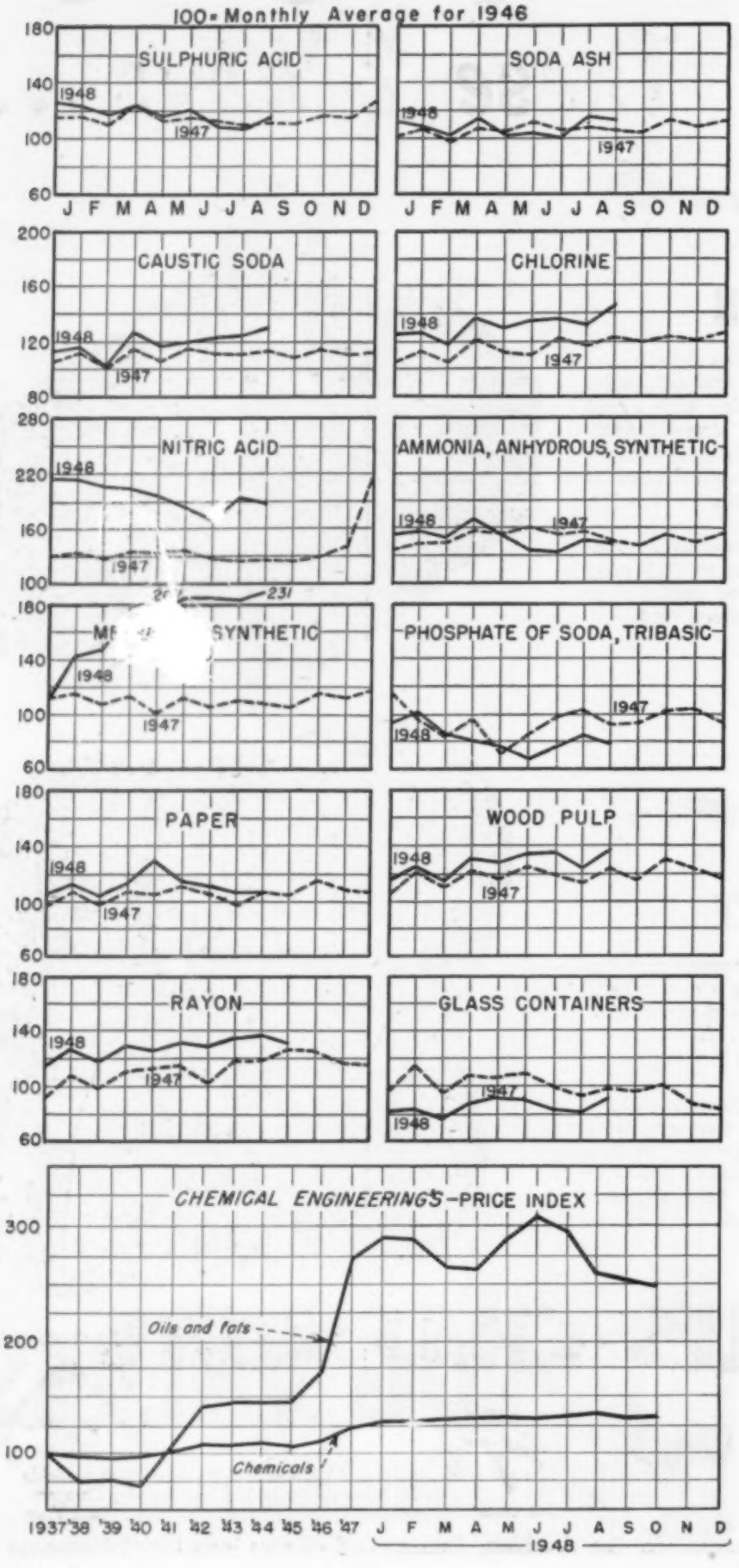
a.c.f. FULL PIPE AREA PLUG VALVES

LUBRICATED

Representatives in more than 50 Principal Cities

Reference Catalog No. 4-CM of types and sizes available on request. Write American Car and Foundry Company, Valve Division, 30 Church Street, New York 8, New York.

PRODUCTION, CONSUMPTION AND PRICE TRENDS



OCTOBER was a big month in the chemical process industries. Preliminary data indicate that it will live up to its reputation as a month in which chemical production peaks are reached.

Complete data on important inorganic chemicals production during August were released last month. The figures bore out preliminary estimates. Production generally was up over July's output and record highs were reported for chlorine, caustic soda, and carbon dioxide. Synthetic ammonium sulphate production was off sharply, as it fell from 14,500 tons in June to about 7,000 tons in August.

Synthetic organic chemicals production data released by the government shows that synthetic methanol production climbed to a new peak in August. July output of phenol and styrene hit a low mark for the year due in part to labor trouble. August was up again.

Glass containers staged a rally in August as production climbed to 8.9 million gross—a rise of more than 14 percent above July.

Rayon consumption in September dropped 5 percent compared with the amount used in August. Nevertheless, the consumption rate is still 17 percent above levels reached in the corresponding 1947 period.

Wood pulp output reached a new high rate in August as production rose to 1,144,000 tons. This is more than 37 percent above the 1946 rate, and illustrates the rapid growth in this industry.

Price Trends

Oil and fat prices dropped in October and by November the *Chemical Engineering* index had fallen to 248.23. But the chemicals price index rose during the month and on November 1, it reached 135.25. However, several chemicals dropped in price. These include ethanol, formaldehyde, and fermentation butyl alcohol. Among the chemicals that rose were phosphates, and lead salts.

Chemical Engineering

WEIGHTED INDEXES OF PRICES

Base = 100 for 1937

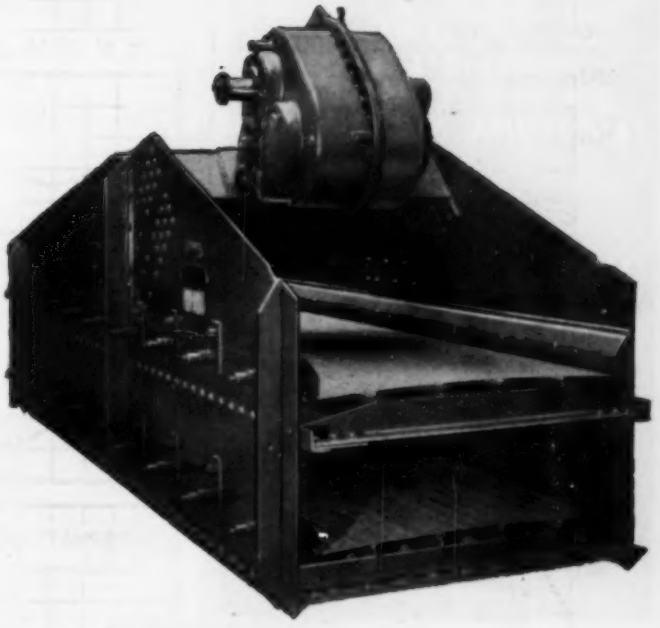
	Chemicals	Oils & Fats
As of November 1	135.25	248.23
Last Month	132.80	249.27
November 1947 ..	128.40	252.98
November 1946 ..	112.66	286.77

Measure Screen Value These 2 Ways ...

CONSTRUCTION

Look at construction first — it has a lot to do with low maintenance and long screen life! Allis-Chalmers builds *Low-Head* vibrating screens of long-lasting high tensile strength steel alloys. All welded parts are "stress-relieved," eliminating local stresses caused by welding. Vibrating mechanism is independently and conveniently located on top of screen — out of the way. Its gears and bearings operate in oil-and-dust-tight steel housing.

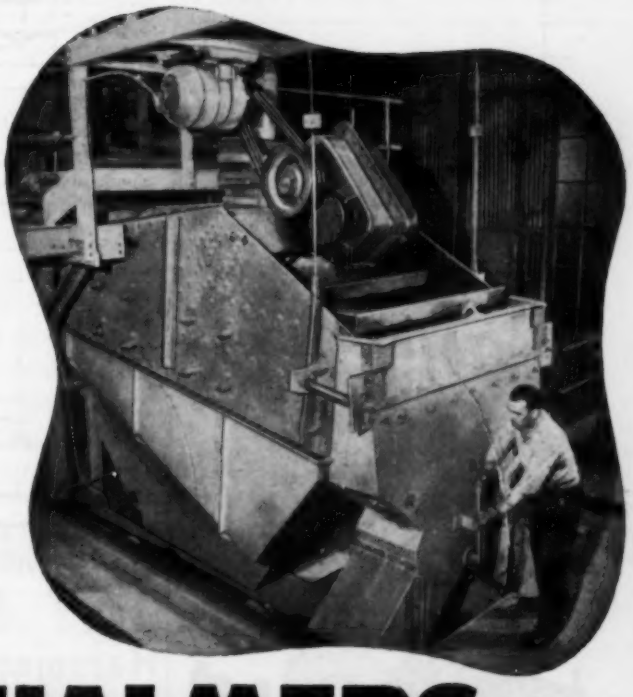
Another important feature of the *Low-Head* screen is the cloth support frame designed to tension screen cloth properly. An increased number of supports and correct crown for different surfaces results in longer screen cloth life!



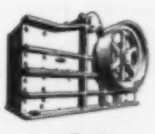
PERFORMANCE

How it works is an equally important measure of screen value. The compact *Low-Head* vibrating screen operates horizontally — saves valuable headroom and space. It can be used for either wet or dry screening ... for dewatering ... or as medium drain and wash screens in heavy density separations.

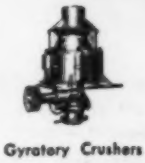
Straight-line motion at 45° to the horizontal results in rapid stratification of feed and a definite conveying action of the material. *Low-Head* screen sizes are from 26 in. x 8 ft to 6 x 16 ft; one, two or three decks. Write for Bulletin 07B6330A. ALLIS-CHALMERS, MILWAUKEE 1, WIS. *Low-Head* is an Allis-Chalmers trademark. A 2517



ALLIS-CHALMERS



Jaw Crushers



Gyratory Crushers

Mills

Kilns, Coolers and Dryers

Hoists

... and Other Equipment for the Crushing, Cement and Mining Industries

FERTILIZER
FROM
NATURAL GAS
We Design
Construct Operate
FACILITIES FOR
PRODUCTION OF
AMMONIA DERIVATIVES
FOR
HIGH
NITROGEN CONTENT
FERTILIZERS
•
Silas Mason
Company
500 FIFTH AVE., NEW YORK
BOX 1162, SHREVEPORT, LOUISIANA

United States Production of Certain Inorganic Chemicals

July 1948, August 1948, and Eight-Month Totals for August 1947 and 1948

Chemical (Tons unless otherwise noted)	July 1948	August 1948	Total, Eight Months 1948	Total, Eight Months 1947
Ammonia, synthetic, anhydrous[1]	89,642	85,556	717,707	738,667
Ammonium nitrate	76,651	79,223	661,582	696,948
Ammonium sulphate, synthetic (M lb.)	27,856	14,245	225,079	257,413
Calcium arsenate (M lb.)	3,273	899	24,784	36,909
Calcium carbide, commercial	53,375	57,443	457,637	419,919
Calcium phosphate:				
Monobasic (M lb.)	5,099	6,643	46,739	40,196
Dibasic (M lb.)	6,546	6,650	50,825	47,968
Carbon dioxide:				
Liquid and gas (M lb.)	36,751	26,996	169,749	164,050
Solid (M lb.)	92,036	26,996	476,376	447,948
Chlorine	129,445	142,412	1,135,136	1,033,035
Chrome green (M lb.)	1,018	1,057	8,478	10,048
Chrome yellow and orange, (C.P.), (M lb.)	3,474	3,493	32 848	31,576
Hydrochloric acid	32,862	35,782	277,834	289,289
Hydrogen (M cu. ft.)	2,148,000	2,402,000	17,985,000	12,486,000
Lead arsenate, acid and basic (M lb.)	506	.....	.....	.....
Molybdate chrome orange, (C.P.), (M lb.)	373	334	3,535	2,822
Nitric acid	92,594	90,318	750,615	645,156
Oxygen (M cu. ft.)	1,205,000	1,328,000	10,443,000	8,923,000
Phosphoric acid (50 percent H_3PO_4)	96,864	102,889	782,936	671,890
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	398,871	394,215	3,407,047	2,995,054
Finished light[3]	202,631	206,857	1,243,461	1,353,444
Finished dense	133,921	127,094	1,000,675	1,130,201
Natural[4]	28,755	28,571	205,578	180,262
Sodium bicarbonate, refined	13,806	13,933	107,649	154,206
Sodium bichromate and chromate	7,850	7,783	62,436	56,601
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	126,720	138,434	1,007,764	900,594
Solid	23,954	29,993	191,898	148,760
Lime-soda process:				
Liquid[5]	67,292	64,850	507,802	504 079
Solid	21,649	22,858	164,005	164,395
Sodium phosphate:				
Monobasic	744	1,009	6,571	9,509
Dibasic	3,015	8,011	51,456	53,492
Tribasic	6,529	6,172	51,582	.....
Meta	2,712	2,905	22,931	19,103
Tetra	4,423	6,623	42,384	35,084
Sodium silicate, anhydrous	38,230	38,085	312,090	313,340
Sodium sulphate:				
Anhydrous, refined	12,671	15,257	.....	.....
Glauber's salt[6]	13,241	14,680	.....	.....
Salt cake, crude, commercial[7]	52,613	50,842	.....	.....
Sulphuric acid[6, 7]				
Chamber process	211,110	228,491	2,022,472	2,216,495
Contact process, new	571,231	609,436	4,789,239	4,422,867

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid materials, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Synthetic Organic Chemicals

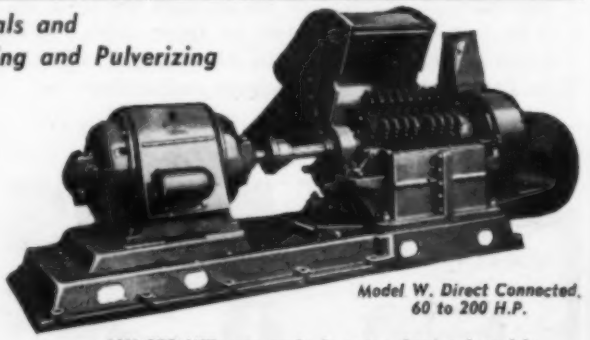
July 1948, July 1947 and Seven-Month Totals for 1948 and 1947

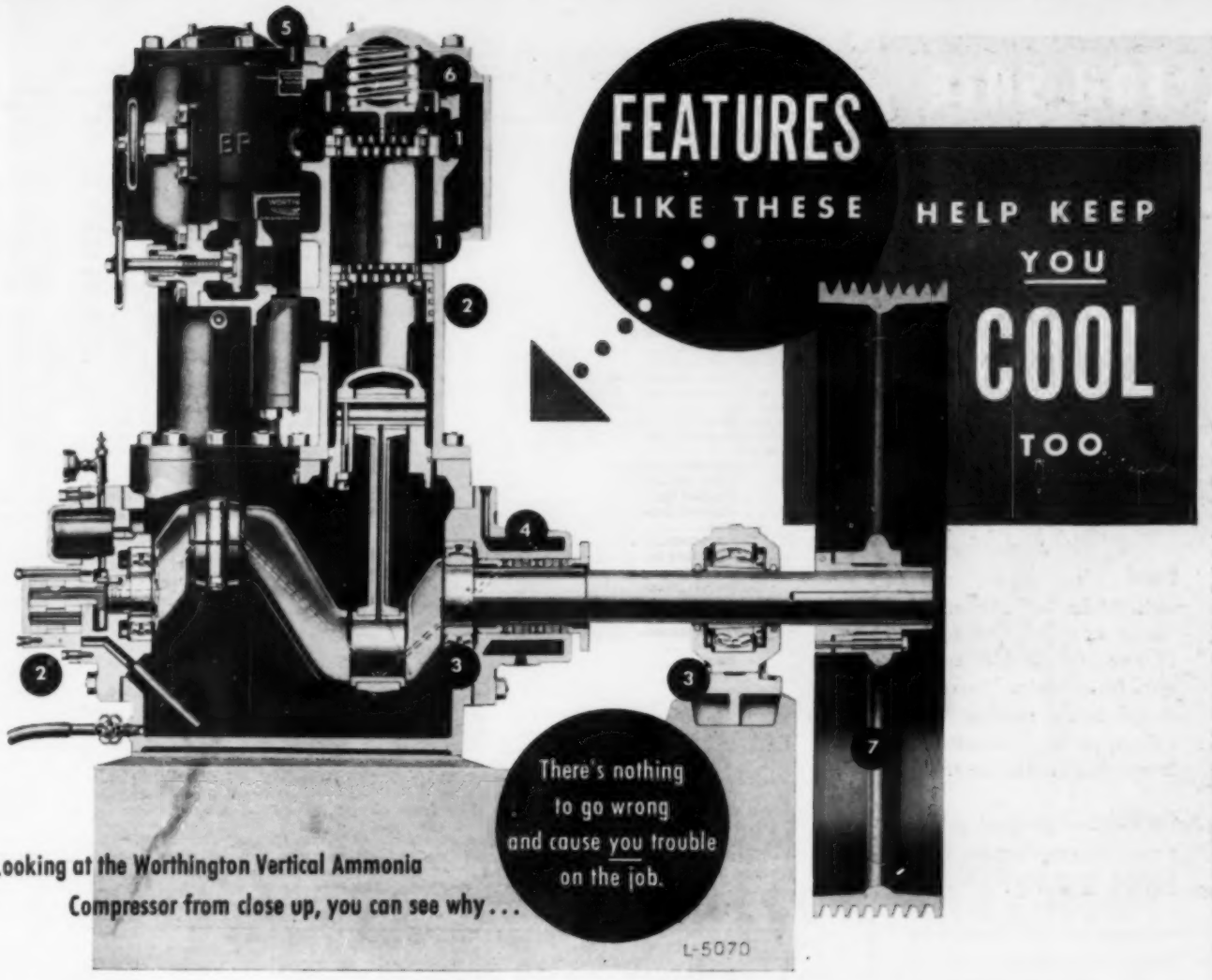
	July 1948	July 1947	Total, Seven Months 1948	Total, Seven Months 1947
Acetanilid	414,675	563,089	.....	4,832,382
Acetic acid:				
Synthetic[1]	35,368,572	33,193,626	237,515,333	216,355,778
Recovered	143,504,337	121,115,145	866,192,081	823,746,634
Natural[2]	2,376,123	2,222,002	15,122,406	14,480,696
Acetic anhydride[3]	63,245,936	52,910,218	430,118,065	350,703,532
Acetone	40,232,737	39,137,918	291,990,147	223,976,663
Acetylsalicylic acid	249,296	998,332	4,536,018	7,029,901

(*Continued on page 374*)

ROTH
STAINLESS
PUMPS
Capacity 2 to 180 GPM
Head 0 to 400 Feet

Write for Bulletin 101
ROY E. ROTH COMPANY
2480 4th Ave.
Rock Island, Illinois

For Agricultural Chemicals and
ALL Industrial Grinding and Pulverizing
JAY BEE
Hammermills
Increase Capacity—
Reduce Operating costs
JAY BEE Mills grind ANYTHING grindable — from feathers to firebrick — with notable efficiency.
Strength, durability and precision of operation are combined to give you maximum capacity and quality grinding at minimum cost.

Model W. Direct Connected, 60 to 200 H.P.
JAY BEE Mills are made in many sizes and models . . . 12 to 200 H.P., for Belt, V-belt or Direct Connected drives . . . for every grinding and pulverizing purpose.
It will pay you to write for details.
J. B. SEDBERRY, Inc., Dept. 18, FRANKLIN, TENN.



The exclusive large-area Worthington Feather* Valve (1)—on both suction and discharge—is the simplest, most durable valve ever made. It consists of flexible ribbon steel strips which seat lightly on ground-face, slotted seats.

Larger sizes have full force-feed lubrication (2) of all running gear; smaller sizes have ample splash lubrication, with self-priming oil pumps and renewable-cartridge filter.

Main and outboard bearings are self-aligning, double-row roller type (3).

The shaft stuffing box (4) is water-jacketed and is extra deep to take the lantern gland and an ample number of packing rings. Oil under pressure is circulated through the gland.

The unit-type manifold (5) has improved quick-opening relief valve. Safety head (6) with ground joint reduces slop-over hazard.

The Worthington Multi-V-Drive (7) includes the easy-on, easy-off, always-tight QD Sheave.

Write us for Bulletin C-1100-B18B giving complete information. *Worthington Pump and Machinery Corporation, Harrison, N. J. Specialists in air conditioning and refrigeration for more than 50 years.*

Part of a balanced system for greater efficiency

The *balanced design* of the Worthington Vertical Ammonia Compressor is duplicated, on a larger scale, in Worthington *systems* for refrigeration and air conditioning.

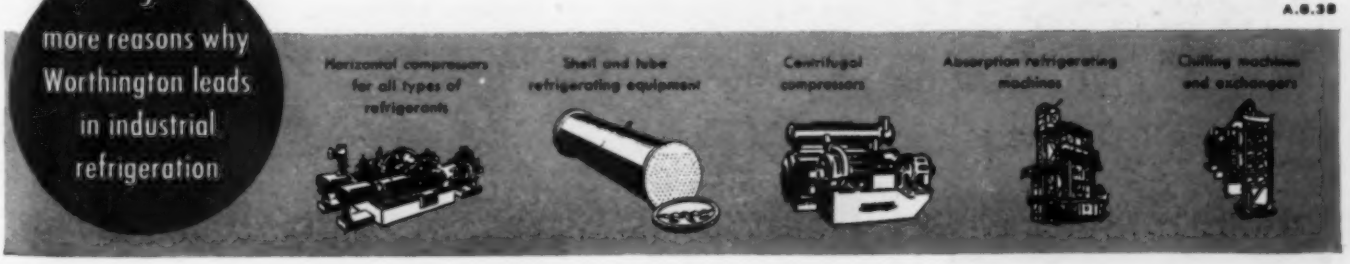
Worthington *manufactures all* the vital "innards"—compressors, condensers, engines, turbines, pumps. The result is a completely *integrated* system—for more efficient, more economical operation.

That's why *there's more worth in Worthington.* See your nearby Worthington distributor—in the Classified Telephone Book.

*Reg. U. S. Pat. Off.

WORTHINGTON

A-6.38



FOR SALE OR LEASE

NEW
Manufacturing Plant
JEFFERSON CITY, MO.

Available Now at Lower Cost than for New Construction

Plant—Main floor 141′ by 91′ with 38′ by 140′ mezzanine. Total floor space 17,780 sq. ft. 15 acre site provides ample space for expansion. Excellent manufacturing facilities with offices, research laboratory, lavatories, First Aid room.

Facilities—Installed power generating equipment with capacity up to 800 KVA. Separate two-story steam plant with new 600 H.P. water tube boiler with forced draft oil burner. Adequate supply of male labor available.

Transportation—Excellent transportation facilities by rail, highway and river. 80′ x 15′ two-car railroad loading dock. Two track entrances 12′ high.

This modern plant was built by private interests for a wet-milling operation. In its present state of completion, it can be converted easily, quickly and at low cost.

For illustrated folder and detailed information see your broker or write:

J. G. CHARLESTON, ROOM 500
318 W. Washington St., Chicago 6

R. VERNON CLARK
Industrial Realtor
224 N. Fourth St. Garfield 4360
St. Louis 2, Missouri

H. C. EDWARDS & CO., INC.
Industrial Realtor
928 Main St. Harrison 6735
Kansas City 6, Missouri

JEFFERSON CITY
CHAMBER OF COMMERCE
Jefferson City, Missouri

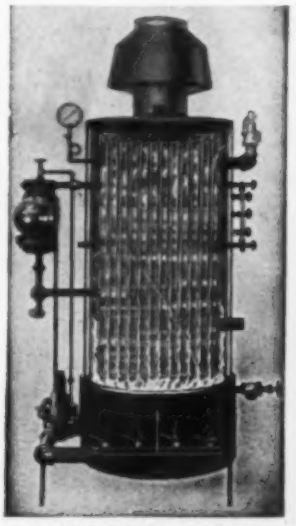
U. S. Production of Certain Organic Chemicals (Cont. from page 372)

	July 1948	July 1947	Total, Seven Months 1948	1947
Aniline	7,242,525	6,240,582	57,618,614	61,264,321
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	25,363	44,781	232,500	265,109
Benzene:				
Motor grade:				
Coke-oven operators[6]	759,567	1,318,764	4,958,972	11,154,933
All other grades:				
Tar distillers[4]	828,719	1,416,269	24,408,020	1,416,269
Coke-oven operators	11,792,858	10,940,432	84,483,749	83,592,232
Butyl alcohol, primary, normal	11,636,009	11,847,240	72,765,296	84,035,838
Carbon bisulphide	29,528,866	28,210,960	234,590,030	201,008,686
Carbon tetrachloride	14,098,277	15,784,934	119,454,154	115,418,094
Chlorobenzene, mono	8,079,403	20,064,218	164,397,542	187,494,136
Creosote oil:				
Tar distillers[6]	8,958,149	8,562,490	62,086,262	72,633,297
Coke-oven operators[6]	2,386,709	3,018,221	21,325,771	22,766,328
Cresols, meta-para	868,442	601,989	5,267,646	3,522,499
Cresols, ortho-meta-para[7]	784,129	827,223	5,112,119	5,613,749
Cresylic acid, refined[4, 10]	2,599,285	2,328,681	16,801,927	15,339,666
Dibutyl phthalate	1,564,257	1,845,772	9,583,786	12,576,058
Dichlorodiphenyltrichloroethane (DDT)	532,680	4,962,453	9,900,456	31,960,802
Ethyl acetate, 85 percent	4,972,103	5,821,503	38,767,808	49,891,121
Ethylene glycol	30,140,226	19,923,468	196,040,272	119,421,118
Ethyl ether	2,563,769	3,409,046	19,708,196	25,464,786
Formaldehyde, 37 percent	45,658,213	40,884,258	370,349,304	309,947,413
Hexachlorocyclohexane	936,083	509,099	10,174,682	2,486,185
Methanol, natural[9]	1,417,713	1,170,008	9,638,769	9,354,897
Methanol, synthetic	89,691,588	45,015,671	521,624,711	313,293,825
Naphthalene:				
Tar distillers, less than 79°C	16,423,232	.....	117,881,583	.....
Tar distillers, 79°C. and over	8,201,504	9,075,254	60,727,379	60,625,779
Coke-oven operators, less than 79°C	7,888,496	8,064,038	55,833,715	54,478,629
Penicillin and salts	6,608,947	2,843,744	51,632,235	19,717,327
Phenol	15,177,809	24,701,138	161,327,354	147,842,604
Phthalic anhydride	12,132,980	12,871,071	89,005,056	78,990,421
Styrene, government and private plants	24,939,959	18,845,273	211,244,349	181,271,927
Toluene:				
Coke-oven operators	2,382,468	2,054,418	16,346,508	15,061,431
All other[5]	2,458,053	3,591,885	.....	17,383,089
Xylene, crude	5,113,905	2,172,403	37,275,467	25,975,034

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

THE *Economical* SOLUTION TO YOUR STEAM PROBLEMS . . .

THE KANE BOILER PACKAGE



The KANE Boiler is built to A.S.M.E. specifications, in sizes to 30 H.P.

. . . a compact, self-contained steam source that includes: the correctly sized KANE Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficency.

Engineered Steam at its best, with four decades of experience at your disposal—so, send your steam problem to us for study and recommendation.

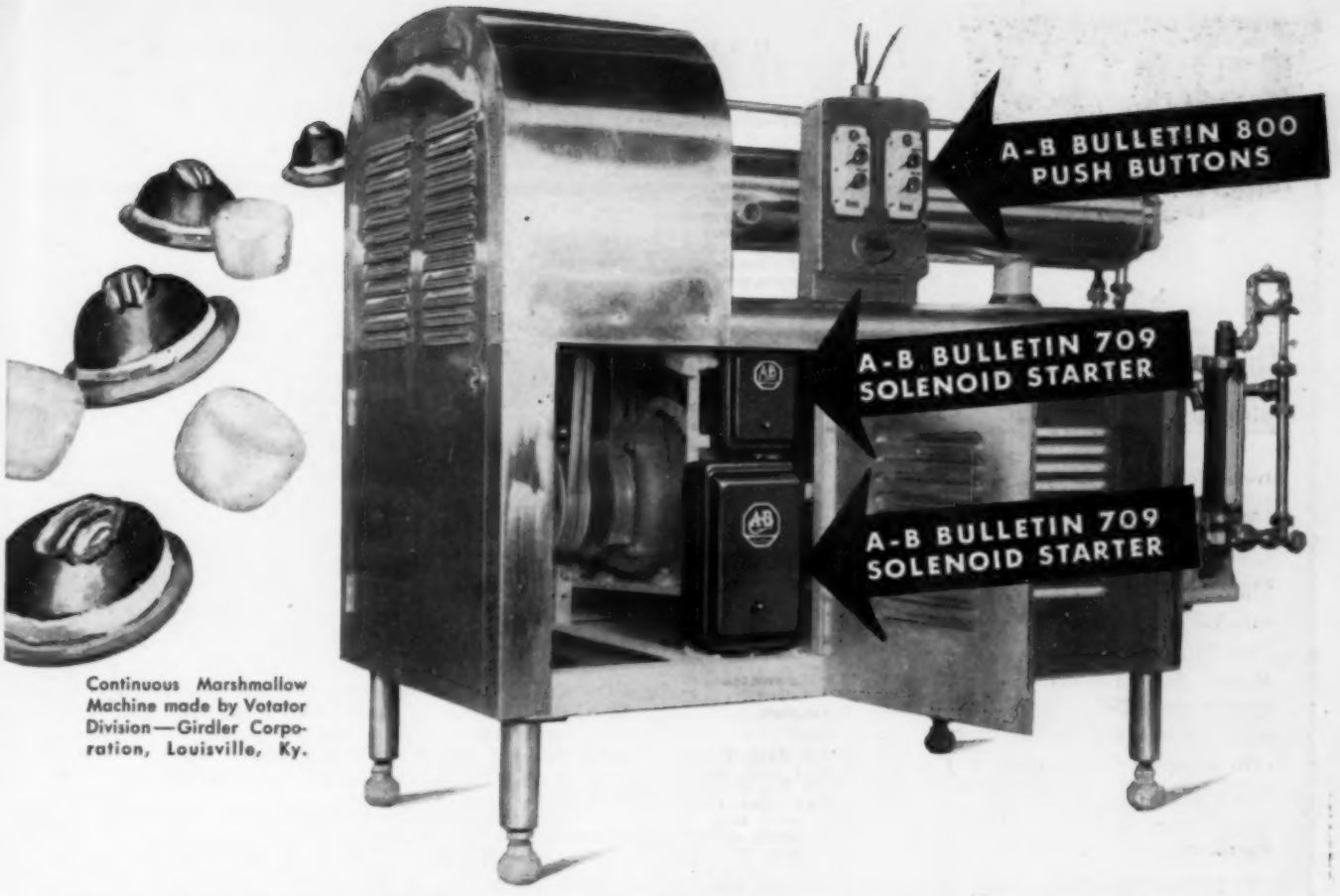
ENGINEERED STEAM AT ITS BEST

The M-K-O Automatic Boiler Feed returns condensate and supplies small quantities of hot water as needed to the KANE Boiler.

MEARS • KANE • OFELDT INC.

1903-1915 EAST HAGERT STREET, PHILADELPHIA 25, PA.

FOUR DECADES OF AUTOMATIC GAS-FIRED BOILER MANUFACTURING EXPERIENCE



Continuous Marshmallow Machine made by Votator Division—Girdler Corporation, Louisville, Ky.

CONTINUOUS MARSHMALLOW MACHINE

operated by Allen-Bradley controls

A continuous marshmallow process! From the kettle the syrup gelatine mixture is metered into the Votator unit, and processed as it flows through the cylinder. It emerges as aerated and cooled marshmallow, and is piped to equipment which deposits the marshmallow on cookies moving on a conveyor belt . . . a continuous production operation.

Such a process requires automatic, dependable motor control . . . and Allen-Bradley solenoid starters are the logical choice. In case of overload, accurate relays trip the starting switches. In case of line failure or blown fuses, no-voltage protection safeguards the operators against accidental restarting. Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wis.

Allen-Bradley Automatic Starters are available in these enclosures

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

A-B Quality

NEW CONSTRUCTION

	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$125,000	$125,000	$3,652,000
Middle Atlantic	$400,000	1,650,000	8,011,000	57,970,000
South	233,000	24,168,000	81,586,000	99,730,000
Middle West	300,000	1,568,000	13,250,000	56,088,000
West of Missippi	2,650,000	12,368,000	213,963,000	104,001,000
Far West	3,100,000	148,000	23,550,000	33,701,000
Canada	.....	.....	92,710,000	38,389,000
Total	$6,683,000	$40,027,000	$433,195,000	$393,531,000

Proposed Work

Calif., Berkeley—Colgate-Palmolive Peet Co., 85 Hudson St., Jersey City, N. J., plans to construct a 5 story spray products plant at Berkeley. Albert Kahn & Associates, Detroit, Mich., Archts. Estimated cost will exceed $100,000.

Ind., Brownstown—Kiefer Paper Mill plans to rebuild its paper mill here which was recently destroyed by fire. Estimated cost $300,000.

Ky., Louisville—Kentucky Paper Box Co., 117 North 6th St., plans to rebuild its manufacturing plant here. Estimated cost will exceed $100,000.

La., Baton Rouge—Ethyl Plant, North Baton Rouge, plans to construct a new Ethyl chloride change house No. 2. Bodman & Murrell, 713 Reynolds Bldg., Archts.

N. Y., Brooklyn—Charles Pfizer & Co., 11 Bartlett St., plans to construct a 3 story chemical laboratory at 429-33 Marcy Ave. Henry Woerman c/o owner, Engr. Estimated cost $100,000.

N. Y., Niagara Falls—Carborundum Co. plans to construct a new 4 story building at its plant here. Estimated cost $300,000.

N. C., Wilmington—Naco Fertilizer Co., Wilmington, plans to rebuild its fertilizer plant. Estimated cost $75,000.

Tex., Houston—Goodyear Synthetic Rubber Corp., (Goodyear Tire & Rubber Co., operators) LaPorte Rd., plans to enlarge its rubber plant to include the manufacture of "cold process" rubber, also a refrigeration plant. Estimated cost $1,000,000.

Tex., Port Neches—B. F. Goodrich Rubber Co., Port Neches, plans to enlarge its plant here for the manufacture of "cold process" rubber, also a refrigeration plant. Estimated cost $1,300,000.

Wash., Anacortes—American Chrome & Magnesium Industries, Inc., c/o A. L. Atherton, Terminal Sales Bldg., Seattle, plans to construct a chrome briquetting plant and concentration mill. Estimated cost $3,000,000.

Wyo., Worland—Pure Oil Co., 118 West 6th St., Tulsa, Okla., plans to construct a sulphur recovery plant. Estimated cost $500,000.

Contracts Awarded

Ark., El Dorado—Lion Oil Co., El Dorado, has awarded the contract for a contact-type sulphuric acid plant to Chemical Construction Corp., Empire State Bldg., New York, N. Y., also ammonium sulfate plant to Blaw-Knox Construction Co., Farmers Bank Bldg., Pittsburgh, Pa. Estimated cost $1,250,000 and $750,000 respectively.

Calif., Los Angeles—Independent Paper Stock Co., 650 7th St., San Francisco, has awarded the contract for a 75x150 ft. wash materials plant to MacIssaac & Menke Co., 3440 East 22nd St. Estimated cost $147,900.

Ga., Elberton—United Rayon Mills, Elberton, have awarded the contract for an addition to their mill to Fiske-Carter Construction Co., Spartanburg, S. C. Estimated cost will exceed $100,000.

Ill., Crystal Lake—Pure Oil Co., 35 East Wacker Dr., Chicago, has awarded the contract for a 3 story administration and chemical laboratory and a 1 and 2 story engineering laboratory to Oscar E. Strom, Crystal Lake. Estimated cost $1,000,000.

Kan., Kansas City—Farm Belt Fertilizer Co., 23rd St. and State Line, has awarded the contract for a fertilizer plant to Long Construction Co., Rialto Bldg. Estimated cost $150,000.

Md., Baltimore—Tin & Chemical Corp., 1900 Chesapeake Ave., Fairfield, has awarded the contract for a 1 story manufacturing plant and a 1 story storage building to The Austin Co., 19 Rector St., New York, N. Y. Estimated cost $150,000.

Mass., Everett—Esso Standard Oil Co., 328 Stuart St., Boston, has awarded the contract for additions to its plant here to Bond Bros., 77 Ferry St. Estimated cost $125,000.

Mo., St. Louis—Monsanto Chemical Co., 100 South 2nd St., has awarded the contract for a warehouse to Gamble Construction Co., 804 Pine St. Estimated cost $68,000.

N. C., Charlotte—National Carbon Co., 11709 Madison St., Cleveland, O., has awarded the contract for a service and office building to Gilmore, Carmichael & Olson Co., 1873 East 55th St., Cleveland.

N. C., Fletcher—Cranston Paint Works, Fletcher, have awarded the contract for a factory to Potter & Schackelford, Inc., Greenville, S. C. Estimated cost $3,500,000.

O., Columbus—Capital City Products Co., 995 Perry St., has awarded the contract for an acidulating building and a still building to Leo E. Ruisinger, Inc., 851 Frebis St., Columbus. Estimated cost $68,000.

O., Hubbard—Newsprint Corporation of America, c/o American Industrial Co., 68 Main St., Buffalo, N. Y., contractor, has acquired a 14 acre site here and will construct a newsprint mill. Estimated cost $500,000.

Pa., Easton—General Aniline & Film Corp., Grasselli, N. J., has awarded the contract for two high pressure laboratories here to E. C. Machin Co., Inc., 1024 North Quebec St., Allentown. Estimated cost $150,000.

Pa., Indiana—King Leather Co. has awarded the contract for a 1 story, 80x140 ft. leather goods factory on Philadelphia St. to Noble Fowler, 408 Locust St. Estimated cost $80,000.

Pa., McKees Rocks—Cheseborough Manufacturing Co., Island Ave. Ext., Pittsburgh, has awarded the contract for a warehouse to E. Hoffman Co., 901 Wood St., Wilkinsburg. Estimated cost $200,000.

Pa., Newell—General Chemical Div. of Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y., has awarded the contract for the design and construction of a nitric acid manufacturing plant and steam generating plant to Wigton-Abbott Corp., 1225 South Ave., Plainfield, N. J. Estimated cost $1,000,000.

Pa., North Wales—Atlas Asbestos Co., North Wales, has awarded the contract for a 1 story, 40x160 ft. factory addition to Ike Heckler, Jr., Funk Rd., Lansdale, Pa. Estimated cost $70,000.

S. C., Camden—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., has acquired an 800 acre site near here and will construct a plant for the manufacture of Orlon acrylic fiber. Estimated cost $20,000,000.

Tex., Ella Switch (Kingsville P. O.)—Humble Oil & Refining Co., Humble Bldg., Houston, has awarded the contract for a gas injection compressor plant near here to Stearns-Rogers Manufacturing Co., 1720 California St., Denver, Colo. Estimated cost $1,200,000.

Tex., Houston—Phillips Chemical Co., Bartlesville, Okla., and City National Bank Bldg., Tulsa, Okla., has awarded the contract for the design and construction of the first section of a chemical plant in Chocolate Bayou area to Chemical Construction Corp., Empire State Bldg., New York, N. Y. Estimated cost $7,500,000.

Tex., San Antonio—Samuels Glass Co., 923 South Alamo St., will construct a warehouse with own forces. Estimated cost $150,000.

Tex., Texas Ciy—Pan American Refinery Corp., c/o Harold R. Snow, Mgr., has awarded the contract for additional chemical and research buildings to H. K. Ferguson Co., M & M Bldg., Houston. Estimated cost $1,300,000.

Va., Pulaski—Jefferson Mills, Pulaski, have awarded the contract for a nylon throwing plant addition to C. M. Guest & Sons, Greensboro, N. C. Estimated cost $500,000.

Superbly Equipped

. . . thoroughly experienced

Typical of our superb marine equipment is the 260-foot work barge and 85-foot sea-going tug, above. With this equipment we built the complete location, right, from foundation to crown block, in 18 feet of water, 15 miles from the shore and 50 miles from supply base, in the Gulf of Mexico. Our experience in building well platforms in varied waters, in dredging for locations inland and in all types of marine jobs dates from pioneer days of this work. Ask us for details.

BROWN & ROOT

Marine Operators Inc.

P. O. BOX 3 HOUSTON, TEXAS

HILCO OIL RECLAIMERS

For Complete Removal of Solids, Moisture and Gases From New and Used Lubricating and Sealing Oils.

- For Vacuum Pumps
- For Absolute Low Pressures
- For Refrigeration Unit Charging

Lasting Lubrication

Save Money — Oil — Equipment

Complete HILCO Vacuum Pump Lube and Sealing Oil. Continuous Purifying System Plans Available

Let us show you how to deliver pure oil to refrigeration units with a HILCO charging system.

HILCO Oil Reclaimer Model B-1

Write for Free Literature

THE HILLIARD CORPORATION
131 W. Fourth St., Elmira, N. Y.

FLOWSHEETS

of the

Chemical Process Industry

● From acetaldehyde to zinc oxide, *Chemical Engineering's* flowsheets of the chemical process industries give in diagrammatic form stepwise details of materials flow and processing. Raw materials, power and labor requirements per unit of product are given in most cases.

Thirty pages larger than the previous edition, the book has thirty-seven new flowsheets—and older sheets which were retained were checked with authorities and the majority of them revised to bring them in line with latest practice.

It's a completely up-to-date reference book of 158 pages, 8½" x 11" in size, in a gold-stamped, simulated leather cover with a metallic ring binder.

Orders should be placed, at $1.50 each, directly with the Editorial Department

CHEMICAL ENGINEERING

A McGraw-Hill Publication ● 330 West 42nd Street, New York 18, N. Y.

A complete chemical engineering library in one volume!

McGraw-Hill has made available to the industry a great manual of chemical engineering standards and practices—the CHEMICAL ENGINEERING HANDBOOK, prepared by a staff of specialists under the editorship of John H. Perry of E. I. du Pont.

This handbook—now in its second edition—serves as a valuable tool for anyone concerned with chemistry in its industrial applications. It puts at the chemist's fingertips hard-to-find data needed in routine problems or investigations of special branches of work. More than that, it provides an authoritative standard against which he can check present methods.

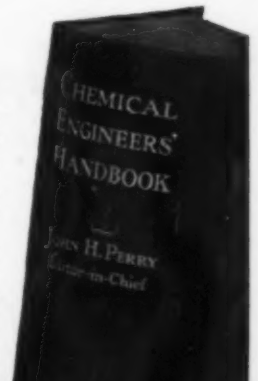
Over 3000 pages of data in this famed Chemical Engineering Handbook

Its size insures full coverage of the chemical engineering field as well as related fields of great importance to the profession. Well organized and written in a clear concise style, the handbook includes 1030 pages of mathematical, physical and chemical fundamentals; 1060 pages of data and practice on unit processes; 740 pages of important engineering data; 129 pages on related business and professional subjects.

The final 70 pages contain a quick-reference index which means time saved for the busy industrial chemist. 1300 illustrations and 1000 tables scattered throughout the book make it definitely a one-volume library.

Available for your examination

The publishers have made the CHEMICAL ENGINEERING HANDBOOK available for free examination. Readers are invited to send for it on 10 days' approval. Payments may be made in small monthly installments. See the coupon below for details.



McGRAW-HILL BOOK CO., Inc.
330 W. 42nd Street, New York 18, N. Y.

Send me Perry's Chemical Engineers' Handbook for 10 days' examination on approval. In 10 days I will send $5.00, plus few cents postage, and $5.00 monthly for three months thereafter, or return the book postpaid. (Postage paid on orders accompanied by remittance of first installment.)

Name .....

Address .....

City and State .....

Company .....

Position ..... CE-F. 11-48